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"STAR SCHOOLS"—TELECOMMUNICATIONS IN EDUCATION

HEARINGS

BEFORE THE

COMMITTEE ON LABOR AND HUMAN RESOURCES UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

EXAMINING THE DEVELOPMENT OF A REGIONAL EDUCATIONAL TELECOMMUNICATION SYSTEM

FEBRUARY 27, 1987, CHARLESTOWN, MA
MARCH 11, 1987, WASHINGTON, DC

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"STAR SCHOOLS"—TELECOMMUNICATIONS IN EDUCATION

FRIDAY, FEBRUARY 27, 1987

U.S. SENATE,
COMMITTEE ON LABOR AND HUMAN RESOURCES,
Charlestown, MA.

The Committee met, pursuant to notice, at 9:30 a.m., in Room No. 175, Bunker Hill Community College, Charlestown, Massachusetts, Senator Edward M. Kennedy (chairman) presiding.

Present: Senator Kennedy.

OPENING STATEMENT OF SENATOR KENNEDY

The CHAIRMAN. The Committee will be in order.

I first want to thank Dr. Shipley very much for all of his help and cooperation and for the support of all of those associated with the Bunker Hill Community College, and for making available this facility and these resources.

It is good to have a chance to come back here again, and I am just delighted, as the Chairman of the Committee on Labor and Human Resources, to be able to commence one of the first hearings outside of Washington that we have had on a subject which I think offers enormous opportunity in the field of education. So it is entirely appropriate that we meet here for this particular session.

The economic battles of tomorrow are being fought in the classrooms of today, and the news from the front is not good. In survey after survey, American students are at the back of the class in math and science achievement. Japanese students score twice as high as our students in chemistry achievement. Japanese students score twice as high as our students in math achievement.

It should come as no surprise that the Japanese also have twice as many engineers working in their industries, and have twice as many patents per capita as we do.

Let's be clear about the causes: American students are as smart as any in the world and, given the resources, they will meet and beat the competition every time.

But our students are not getting the training they need to succeed in the economy of the future. Only 35 percent of the high schools in America even offer a physics course. And even where courses are offered, the instructors are often not equipped to teach them.

The National Science Teachers Association estimates that 30 percent of all math and science teachers in this country are completely unqualified or seriously underqualified to teach these subjects. And this will worsen quickly unless we act now. By 1995, the Na-

tional Science Board reports that we will need twice as many teachers in math and science as we have today. But, for every qualified math or science teacher entering the field, 13 are leaving.

And I think this chart demonstrates quite clearly what our situation is—the estimated need will be some 300,000 in the math and science teaching force, and currently we have 140,000. The difficulty is moving from this 140,000 to 300,000.

If we were able to provide all of the additional training necessary, it would take an enormous commitment of resources.

And given where we are in terms of the pressures that all of us are feeling with competing, priorities in terms of student aid, and many other educational programs which are essential at a time of scarce resources. And we have to deal with this particular challenge.

One of the things I think all of us understand, or we should understand, is that we are facing sizable deficit issues and problems in our country. I think they can be dealt with if we have the will and the real desire to do so, with the Executive and the Congress working together and going to the American people.

On the trade issues, it is not easy because we know the time it takes to train teachers, we know the time it takes to train individuals, we know the resources which are necessary, and we have a very serious adverse situation in the country today.

These indices in math and science and physics are clearly troublesome, and the trends have to be reversed if we are going to begin to be serious about meeting that challenge.

The costs to this nation of a continued failure to teach math and science to our children will be enormous. The very least we will lose will be billions upon billions of dollars in trade revenue. The true cost of our inaction will be the lost talents of an entire generation of our people, and that is ground we shall never regain.

I am proud to be able to say that again Massachusetts is creating a better future. I call the concept "Star Schools," and the idea is to harness satellite technology to reduce the shortage of qualified teachers and close the gaps that plague so many of our schools, especially in science and math. By making satellite time available to teachers and students on a regular basis, we can make quality education and instruction far more widely and equally available than it is today. With a satellite dish outside the door, even a one-room schoolhouse can tap a whole world of knowledge.

We have had some important testimony by Dr. Knapp in our National Goals and Education Program. Recently, in Washington, we held our first set of hearings to review where we are in the broad areas of education, health, employment, and some of the other areas of human need. We had some impressive testimony at that time. It is good to see him here again today.

The technology is available, and the cost of "Star Schools" is only a tiny fraction of the cost of "Star Wars," and there is another difference—"Star Schools" works.

It is estimated that the cost of a national program to train, hire, and upgrade the nation's math and science teachers so that America's students would have qualified instruction available would be between $10 and $20 million. And we now estimate the cost of a

national "Star Schools" program at about $100 million. Properly designed, such a system could pay for itself.

Again we find that we do not have to spend more to do more if we think cleverly about the use of our resources. Let's make this clear. American students deserve "A-plus" education, and next week I will introduce legislation to bring the "Star Schools" to American education.

This hearing today will be very helpful to our Committee in gathering the support for our proposal, and hopefully fast tracking that legislation on the floor of the Senate.

With the example of what Massachusetts and New England can do, we shall once again make good on the promise of American achievement, and the sky is the limit.

We are pleased to move through the course of our hearing. We will hear from Dr. Duffey, and we welcome him and look forward to his testimony. He is Chancellor of the University of Massachusetts at Amherst, and he was the former Director of the National Endowment for the Humanities.

We are glad to have Dr. Duffey joining us. We heard some very promising things about the MCET Program, and we are looking forward to his testimony.

Doctor.

STATEMENT OF DR. JOSEPH DUFFEY, CHANCELLOR, UNIVERSITY OF MASSACHUSETTS; FORMER DIRECTOR, NATIONAL ENDOWMENT FOR THE HUMANITIES

Dr. DUFFEY. Thank you.

Senator Kennedy, I want to leave my prepared remarks here and just speak very informally.

I have seen the witness list you have before you. Let me simply try to provide a background in introductions to the testimony you are going to hear.

First of all, I want to express our appreciation for your bringing this, I think, the first regional hearing with your new Chairmanship of the Labor and Human Resource Committee here to the Commonwealth. And I think it is very appropriate that we are here in Bunker Hill Community College.

You have a strong and abiding and long interest in education that cheered many of us when you were willing to take these responsibilities. And in the Commonwealth, we value education and knowledge because it is our natural resource. It is what makes this economy work. And what I want to talk about is the use of new technology to straighten that particular system.

I left my home in Amherst about three hours ago. I work for Dr. Knapp, who is here in Boston. We are separated by 100 miles.

The Community College here is a part of a system. We feel we are, as Bud Hodgkinson now says, in American higher education, including the elementary and public schools and the colleges and the community colleges, all one system which has to function very efficiently in the future.

I think the most interesting comments in this Administration about education are not coming from the Secretary of Education, but from the Secretary of Labor. Mr. Brock has probably spoken

more compellingly about the fact that in the very near future, we simply will not have surplus population in the United States.

The motto of the black colleges that "a mind is a terrible thing to waste," now ought to be also translated "a mind if a very costly thing to waste."

We are going to need every American trained to the maximum potential in order to have a strong and competitive economy. And we learned that lesson in New England. It is one that matters a great deal to us.

I want to talk about the Massachusetts Education Television Corporation. Dr. Knapp has talked about this concept with you in Washington. Let me try to add just a few more details about the concept here.

First of all, as we are both aware, within the last decade, we have seen telecommunications applied to education in several parts of the country.

When I was at the National Endowment for the Humanities, I tried to provide some programming for the network in Kentucky, which serves part of Appalachia, which the Federal Government helped to establish as a model network. South Carolina has an excellent network.

Here in Massachusetts, we have tried to address this problem, one, in terms of some of the shortcomings of the other networks, that is the breadth of institutional cooperation. The approach we have taken involves public and private universities.

I want to talk a moment about the relationship of the campus at Amherst with Boston University, represented by Dr. Jones here today.

My friend John Silber and I, I do not think, are ever going to agree on policy in Central America, but we agree very much on the importance of cooperating between our two institutions for the plan that we are proposing here.

But the health care centers across—health delivery centers across Massachusetts are a part of this corporation; the public schools, the industry. So it is unique in the country in having the breadth of cooperation.

In beginning to address the problem, as I am going to talk in a moment about teaching in the public schools and subjects where we do not have teachers, which is a sensitive problem, to members of our teachers unions.

We are very pleased at the foresight of the MTA in Massachusetts in endorsing the Massachusetts Education Television Corporation.

I want to stress the fact, however, that these institutional networks are still—they are a very important part of the process. We have a lot to learn, but in Massachusetts we have moved ahead in terms of getting that cooperation started.

There are things we can do with satellite technology: addressing programs to specific locations; combining computers and television; getting interactive technology, which has just emerged on a practical basis within the last several years.

What we are proposing in Massachusetts is to take a statewide microwave link.

Let me say, first of all, that if this link, and what I am going to talk about in a moment, were in effect, I could still be in Amherst and you could be here. That probably would not be as pleasant, but we could communicate quite directly with very high resolution television through a microwave transmitter such as this.

Or your signal here could be moved from here through this microwave "spy," which is what we call this system, into a transmitter at Boston University to a satellite into every high school in the State, and we could actually have response and questioning. The potential of that, and its effective use, is just enormous for the kind of problems that you have addressed and I want to speak of in a moment.

Here we have Emerson College's new pamphlets and the University of Lowell, all the many fine institutions in Boston: the University of Massachusetts in Boston, Boston University, Northeastern, MIT, Harvard, Southeastern University; the Woods Hole Oceanographic Center, and other resources on Cape Cod; the Medical School of Worcester; the five colleges of Amherst; the Technical Community College at Springfield and other fine colleges there; colleges in the far western part of the State.

Now, this provides a basic microwave link between the institutions. What we want to do, which again is another unique factor, is to put in Boston, at Boston University, and at Amherst, at the University of Massachusetts, satellite transmitters which would enable the programming which comes from any of these institutions, and in a moment we will look at the New England network, part of which is now in place.

So that programming by satellite then becomes available, again with a dish not a lot larger than this at any high school in the State.

I am running into an interesting problem at the University of Massachusetts, Amherst. As our admissions standards and expectations rise, we find many very keen, bright, capable students who come from many of the rural areas in Massachusetts, who have not been able to get in high school the courses we expect them to have to get a head start in college.

We are working with President Chively, who is here now at other community colleges, to try to conserve our resources and theirs by training engineers—we need more engineers in this State—with the first two years at a community college and then coming into the university.

The potential of doing that without the community colleges building elaborate engineering faculties, or at least with certain courses—and this is a balance of how much you use by educational television--from the Amherst campus to all our fine community colleges so that in their first two years these students are not losing those courses; or high school students in rural areas, or areas where, because of a decline in enrollment or shortage of math and science teachers, they are not getting the preparation that they are quite ready for in high school. This could all be addressed by this system.

Two things are novel and I think models in this system, and we still need to refine them. We have gotten the institutional network, the infrastructure of institutions cooperating, the possibility of

having a scientist, who has taken a job at Wang or at Prime, teach one course in a highly specialized math or computer area from every high school in the State that wants to receive that course through this network is an enormous potential.

And Dr. Jones will talk about the experience that Boston University and we have had at Amherst in advanced engineering education.

Many of our teachers are discovering with their best students they had a hard time keeping up with them in certain areas. They need opportunities on-site or continuing education. So that can be provided to this system.

We can do advanced professional training for engineers and other professionals. Our health networks can share information. And we see a course of vast regional significance through the New England network.

If a small business college in the Boston area wants to offer languages to its students, because they are a very important part of training for international business today, and cannot get the faculty available, Middlebury College or the University of Massachusetts at Amherst, or Boston University or another school can provide those kind of resources in their curriculum.

In short, for primary and secondary school students, telecommunications can provide advanced science, math, and foreign language courses we cannot afford to offer at every individual school.

High schools in many parts of this State have been forced to drop courses in specialized subjects because of declining enrollment and a shortage of qualified teachers in some subjects.

For teachers, the network can enable them to continue their training and keep up with rapid changes in such fields as science and computer education.

For college faculty and students, even at the largest research universities, the network can provide currently unavailable accessed information at other institutions.

I have a feeling, for example, one of the things we have been trying to develop at Amherst is much greater capacity in languages in the Pacific Basin and understanding of the economies of the Pacific Basin. We cannot build, even in a fine center with five colleges, all the critical resources to do that array of courses. But if we could work with the other institutions in this State, then really a model in that highly specialized area could be provided.

And for the industrial work force, telecommunications can provide continuing education, courses in advanced engineering, computer sciences and business subjects that are urgently needed if our region and our country are to compete successfully.

We know at Amherst that education by television for professionals works because we have 500 institutions in the country, from Los Alamos and Lawrence Labs in California to nearly every IBM facility in the United States receiving courses by satellite from our advanced engineering training program. And I know Boston University has the same experience, on which Dr. Jones will elaborate.

In short, we are ready for an experiment. We are confident that we have the institutional human resources together, and that has not been easy. We have that cooperation ready.

We now know that the technology is ahead of us, and if we can apply it, we can vote more effectively and bring together all the resources of our region for this important task for the future of quality education for all our students. And we hope that this rather ambitious plan, but a bold one that we think fits this region, is one that we can proceed on within the next five years.

I thank you for the opportunity to present it, and I will be glad to respond to questions or ask others to join me in response to questions.

The CHAIRMAN. Thank you very much, Dr. Duffey.

Excellent presentation. Could you tell us in a little bit what the obstacles are at the present time for being able to achieve some of the ambitious goals which you have?

Dr. DUFFEY. As I think about the experience across the country with the networks in place—and as I say, that really goes back about a decade—we have not had much activity since the mid or late seventies. So we have in place some programs.

One thing we have learned is that you cannot simply throw the technology up. You have to carefully prepare for that.

We think we are in line. We have that process started, and that is not easy in Massachusetts where we have all these individual school districts. But we feel that with this corporation created by the legislature several years ago, and the strong support of industry and the public and private universities, we have moved to that point.

But another obstacle, and I think clearly demonstrated in several States where this system has been attempted, is that you need the preparation of teachers for the use of the material.

And part of our plan is to put at Boston University in Boston and at Amherst, in the two sections of the State, resource centers where programs are being developed. But teachers are coming in for periods of time over the summer for conferences to learn about the use of technology.

You always need the human element, you need the teachers as a part of this process. And I think that obstacle of a close working relationship, that sort of network between the universities, the community colleges, the universities and community colleges, and the high schools or the teachers, is an obstacle.

And the other obstacle for us, of course, is simply to get the technology in place. We have worked on the human infrastructure, and we have the vision now. We think those are all manageable obstacles, but they are our next step.

The CHAIRMAN. If you got the financial support for the corporation, can you give us some idea of the time frame of implementation for this program?

Dr. DUFFEY. The microwave network is not a big problem. The towers are there.

I think we would hope to be operational—I would ask Dr. Knapp to study this more closely—I would think with two years we would hope to be ready to operate.

Dr. KNAPP. Yes, 18 months.

Dr. DUFFEY. Eighteen months.

In Massachusetts, when you can get anything done in 18 months in the public sector, that is an achievement.

But it is not elaborate. There are resource centers. When you put the two dishes, transmission stations, which I suppose is the most complex part of this system, the dishes for the high schools are not a problem. And that is a very low expense.

And one of the things that appeals to me about this in New England, and especially in the Commonwealth, is that our school system–we have public schools and an outstanding network of parochial schools. And there is no distinction. We have private academies of one kind or another.

This material is available and shares those resources in a way that transcends those particular problems. So that I think that the demonstration, particularly here, would be significant in the sense of broad community participation across some of the separation of institutions in the educational sector.

But we would like to be moving within 18 months to two years.

The CHAIRMAN. As they develop, say in the 18-month period, you probably have a preliminary group of courses that would be available both for high schools and colleges. Am I right?

Dr. DUFFEY. I understand from Mr. Borten that since the corporation was created—Rick Borten is the Director of the corporation—he has already begun to receive from institutions, and I mention a business school, I suppose a very fine business college in the area, which has already said to Rick, "What can we do about language teaching? Can we get Middlebury and other schools?"

I am sure you probably have other examples. You are already getting a list.

Mr. BORTEN. The kinds of examples, Senator, that we have encountered and that are actually operational——

The CHAIRMAN. Do you want to just identify yourself?

Mr. BORTEN. My name is Rick Borten, and I am the Executive Director of MCET.

Even at this moment, we are conducting a project with the Area Health Education Council in which a major teaching hospital is transmitting continuing education information to community hospitals that otherwise would not be exposed to this kind of medical experience.

A typical ongoing project is a Physics Forum for high school teachers, many of whom do not have bachelor's degrees in physics, but are chemistry or general science graduates who have been asked to take on a class in physics. These teachers feel kind of isolated, feel that they need help. And this ongoing one-year project allows them, through telecommunications, to consult with their colleagues, learn what is happening, and how they can better, more effectively be physics teachers at the high school level.

Dr. DUFFEY. I can give you an example there in terms of a new technology.

I went to Atlanta about a year ago to look at some of the potential high-resolution television.

One of the dilemmas in cell analysis, let's take the cancer diagnosis for doctors, is the ability to be able to consult and read slices, and it has really been impossible to use television as a way of looking at something as fine and precise as that.

But the high resolution television now makes it possible for a doctor in a rural area to consult with a doctor in Worcester, and

both of them examine, on television, a slide presentation. The resolution is that precise with the new technology.

And what we are planning to use here would provide that kind of resolution which provides, for medical and other purposes, the reading of diagrams and other things; a particularly added dimension that simply was not there even three to four years ago.

The CHAIRMAN. As I understand the scope of this, this is developed for a regional kind of experimentation. I think it is certainly more than an experiment. And with success in this particular region, it would have more general and broader application in terms of a national program.

Dr. DUFFEY. Yes. I think if we can demonstrate the models of the resource centers, and the models of cooperation, that can then become the—perhaps even the requirements for the systems in other parts of the country. We will establish, we hope, a model situation.

We have a great deal to learn about that, but Dr. Knapp and Dr. Borten have made a tremendous start. And we look forward to working with Boston University in sharing the responsibility for the two resource centers.

The CHAIRMAN. Great.

Thank you very much, Mr. Duffey. We hope that you will be able to stay with us for a little while during the course of our hearing.

We will go to our first panel. It will be Andy Turner, who is a math/science student at Chelmsford High School; Karen Powers, a math/science student at Matignon High School in Cambridge.

Maybe we will start with you, Andy. We want to thank you for your willingness to join with us here today.

Maybe you would just start off by telling us a little bit about yourself, where you go to school, where you live, what grade you are in.

STATEMENTS OF ANDY TURNER, MATH/SCIENCE STUDENT, CHELMSFORD HIGH SCHOOL, AND KAREN POWERS, MATH/SCIENCE STUDENT, MATIGNON HIGH SCHOOL, CAMBRIDGE

Mr. TURNER. My name is Andy Turner. I am 16, and I am a junior at Chelmsford High School.

I have been doing math and science at the University of Lowell as a special student for about a year and a half now. I went last summer at the end of my school year. I started there with physics and math, and I am specializing more in math.

I had to ride my bike to the University of Lowell over the summer, and I ground that into the ground. I went through two bikes, four tires, a chain, and two major overhauls.

The CHAIRMAN. Tell us a little bit about how much math and science you have had at Chelmsford High School.

Mr. TURNER. I have had a total of—I started with a total of two years of advanced high school math at Chelmsford High School.

The CHAIRMAN. And then you were in what grade?

Mr. TURNER. I was a sophomore.

The CHAIRMAN. And you wanted to continue to take other courses?

Mr. TURNER. Yes.

The CHAIRMAN. And were those courses available to you at the high school?

Mr. TURNER. They were available, but they would take two full years to do the same as a year at the University of Lowell.

So I went to the University of Lowell that summer and took the same classes. And then I just continued on through this year with the next two courses. I am up through differential equations.

The CHAIRMAN. So you are now—after taking the courses, there is some kind of hook-up at Lowell?

Mr. TURNER. Yes, there is.

The CHAIRMAN. When did that take place?

Mr. TURNER. That started around Christmas time.

The CHAIRMAN. So you are able to hook up now and use what kind of technology?

Mr. TURNER. We use basically a TV station in the Lowell area or the Merrimack Valley.

Both schools have a television station, so we basically transmit to one another the signals that we would normally transmit over the microwave network.

The CHAIRMAN. So you are getting the courses now, is that right?

Mr. TURNER. Yes.

The CHAIRMAN. And you do not have to go to Lowell?

Mr. TURNER. Not any more.

The CHAIRMAN. How many other students are taking these courses?

Mr. TURNER. There are three other students that are taking the same classes I am at Chelmsford.

The CHAIRMAN. Did they ride their bikes?

Mr. TURNER. No, they did not. They took the courses that were offered at the high school.

The CHAIRMAN. I see. But it is your sense that they would not have been able to continue their education without this television, or it would have been much more difficult for them to?

Mr. TURNER. Yes, it would have been. I would say 10 times as difficult.

The CHAIRMAN. And so this technology provides you with the opportunity to take advantage of the courses that are in Lowell. But you are not hooked up—your high school is not hooked up to other kinds of educational facilities?

Mr. TURNER. No. It is just hooked up to the University of Lowell.

The CHAIRMAN. And do you plan to continue your studies in math and science?

Mr. TURNER. Oh, yes. It allows me to do a lot more of the advanced courses offered at both schools. And it also works just as well as being in a classroom, either at the university or at the high school. There is really not much difference.

The CHAIRMAN. Okay.

Can you tell us, Karen, a little bit about your own circumstance? I understand you are a math/science student at Matignon High School, is that correct?

Ms. POWERS. Yes. Matignon High School in Cambridge.

The CHAIRMAN. What classes are you in?

Ms. POWERS. Well, right now, I am taking calculus and physics for my math and science.

The CHAIRMAN. Are you a sophomore or a junior?

Ms. POWERS. I am a senior.

The CHAIRMAN. You are a senior?

Ms. POWERS. Yes.

Like Andy, I found my school is very good, you know, with math and science, but I found that I had to go to additional resources.

And this summer, I attended the Massachusetts Advanced Studies Program at Milton Academy. I took a course in math and a course in science.

And my story is that many students are not able to make that sacrifice. The top five students at Matignon were invited to go to Milton, and I was the only one that was able to because of working during the summer and saving money.

And I feel that if the courses were available on the telecommunications network that the students would have been able to make the attempt to reach their potential.

The CHAIRMAN. I imagine this affects an awful lot of the students. About 65 percent of all the students in our State get some kind of financial help and assistance, and there is increasing pressure on them, as a matter of fact, because of the recent years of the cutbacks.

And so I think it is pretty understandable that students have to work over the course of the summer. A lot of them have to work during the course of the school year as well.

Have you had any kind of experience in using this kind of technology in a learning experience?

Ms. POWERS. No. Matignon does not offer any.

The CHAIRMAN. But you think that you would be able to benefit from that kind of technology in carrying forward your own interests or your own education?

Ms. POWERS. Yes.

The CHAIRMAN. Do you want to continue in the areas of math and science in college?

Ms. POWERS. Yes. I hope to go into engineering.

The CHAIRMAN. It is important in being able to reach your own potential that you have available to you these kinds of courses.

Without that kind of help and support, do you find it makes it more difficult to interest your classmates in science and math and physics?

Ms. POWERS. Well, I believe—I have seen people do want to get involved, and that the students who did not attend Milton wanted to. They just could not. And I think that the desire is still there, but the opportunity is not.

The CHAIRMAN. Okay. Very, very helpful.

All right. Well, we hope you will stay with us. We are going to go to another panel. Thank you.

I wish you the best of luck. You deserve a lot of credit for your perseverance.

You are missing class today, are you?

Hope you might be able to stay the remainder of the hearing. If you have to go, we understand that as well.

We have the next panel with some teachers. We would ask Joe McDonald, Middleborough High School, who is a Librarian/Com-

puter Science Director; and Roxanne Mendrinos if they would be good enough to come up, and Earl Batchelder.

Roxanne Mendrinos, a teacher/librarian, Thurston Junior High School in Cambridge, Chair of the Telecommunications Subcommittee for the Mass. Computer-Using Educators.

And Earl Batchelder is Executive Director of the Hampshire County Educational Collaborative.

Roxanne, maybe we will start with you, if you would tell us a little bit about your own kind of background as a teacher.

STATEMENTS OF ROXANNE MENDRINOS, TEACHER/LIBRARIAN, THURSTON JUNIOR HIGH SCHOOL, WESTWOOD, CHAIRPERSON, TELECOMMUNICATIONS SUBCOMMITTEE, MASSACHUSETTS COMPUTER-USING EDUCATORS; EARL BATCHELDER, EXECUTIVE DIRECTOR, HAMPSHIRE COUNTY EDUCATIONAL COLLABORATIVE; JOE McDONALD, LIBRARIAN/COMPUTER SCIENCE DIRECTOR, MIDDLEBOROUGH HIGH SCHOOL

Ms. MENDRINOS. I am Director of Library Media and Computer Applications at the Edmund W. Thurston Junior High School in Westwood, Massachusetts.

I started the computer program there and went into training teachers to use technology, state of the art technology as a tool within their curriculum. I do a lot of teacher training for Fitchburg State College also.

I strongly believe in continuing education for teachers, especially in the field of technology. I feel that it is imperative for teachers to be trained in state of the art tools for instruction. In many cases, students spend hours at the computer and are getting ahead of their teachers.

Teachers would like to attend universities for higher degrees but, unlike industry, they are not compensated financially or they cannot be given time to travel during the schoolday to take courses.

I would like to pursue a Doctorate at Harvard with a concentration in technology. However, many of the courses meet during the schoolday and there are no summer courses offered. Therefore I would have to leave teaching in order to pursue a higher degree and, financially, that is not feasible.

Courses for teacher training could be offered through telecommunications, especially the audio-video type of telecommunications we are talking about.

During free periods or after school, a lecture room can be set aside where teachers can be part of a university course on the job location. And being in a high tech area, a lot of the industries in our area do this, provide this type of opportunity for their workers, on-the-job training.

It would also encourage quality continuing education, vital in rapidly changing fields of study, such as computer science, science and math.

If the United States is to compete with other technologically advanced nations and maintain a lead, continuing teacher education is a necessity.

That is my first point.

My second point is as a parent, I recently attended the course selection workshop at Medfield High School. Medfield High School has a population of 600 students. The principal stated that there was a strong possibility that advanced physics II, advanced calculus, and Latin would be dropped from the curriculum.

With 67 singletons scheduled and declining enrollment, flexibility and scheduling was severely limited. The School Committee passed a ruling that if a course had less than 12 students, it would not be financially feasible and would be dropped from the curriculum. Understandably, the parents were very concerned.

Medfield students scored very well on the Massachusetts Basic Skills Testing Program, but with limited course offerings, would they continue to do so?

Telecommunications is a solution to this problem.

The CHAIRMAN. Is it your experience from talking to others around our Commonwealth that this type of a situation exists in other communities as well, that is the danger of dropping courses?

Ms. MENDRINOS. Yes. And with declining enrollment——

The CHAIRMAN. There is going to be more pressure.

You are saying that there is pressure already, and with declining enrollment and what we know about the flow in demography, that this is a real danger in other communities as well?

Ms. MENDRINOS. Right.

The CHAIRMAN. Not only, I suppose, in our State but, I suppose, in other parts of the country.

Ms. MENDRINOS. Exactly.

And I think MCET, by investigating this type of solution for this kind of a problem, is looking ahead.

The CHAIRMAN. Okay.

Mr. Batchelder.

Mr. BATCHELDER. I would support the concern about what is going to be happening to a number of courses.

I represent about 15 school districts in Hampshire County. Of those, there are 10 consolidated or separate high schools.

It is not uncommon for a school system to have a policy which says that if an enrollment drops below 10, it is subject to the axe.

I have brought along a list of courses that are offered by—that are currently being offered by three small communities, and I am speaking primarily, I think, but not exclusively for the small communities.

And of those three communities, they are offering a substantial number of courses which have enrollments of two, three, four, five, six; very cost-ineffective and putting a considerable drain on budgets which are not particularly large to begin with.

However, more significant on that list are the courses which are not there. Within those three communities, there is not a single advanced placement course offered.

German has been dropped from any school that might have had it at one time—at one time one of those school did have it; courses such as Russian and Latin clearly are not offered; nor are Russian and Chinese, although those are offered in Amherst and some of the other larger and more affluent communities.

Certainly advanced courses in mathematics are not available. And then, to compound the problem, even where courses are avail-

able in the sciences, chemistry and physics, for instance, it might be one course which is supposed to be suitable for any student who enrolls in it.

And, of course, if there is an attempt—if education is supposed to provide an attempt to provide appropriate education for each child, that simply is not being served because, in effect, the teacher has to deal with any student who is enrolled, and the effect is that it might be too difficult for some students, not difficult enough for others.

Larger school systems have an opportunity to section and to be able to provide different levels of instruction appropriate to the individual needs of the students. Smaller school systems simply cannot do that.

I think that the basic concern that we have is that with all of the attention that has been given to education, to excellence in education, and to quality and equality of education, one of the things that is not being addressed successfully in any kind of a universal fashion is an equality of educational opportunity.

This is a concern for the cities, it appears, and certainly for very many justifiable reasons. But it is just as much a concern for many other places, school systems, where by accident of geography, a student who is in the town of Hatfield, does not have access to anywhere nearly the number of courses that might be available to a student in Amherst.

I know that this is enough of a concern to so many of the school systems in my area, and I might say further west also in the Berkshire area, that a number of us have been getting together to talk about some kind of independent effort, if necessary, to try to bring television, to bring the schools together.

Examples of that do exist elsewhere. There has already been a pilot project established between two affluent communities, Needham and Wayland, for instance. That is, it was quite possible in their case because they had a common cablevision company. That does not exist in our case.

So it is more complex with many of ours, but we realize that there is a serious problem about providing educational opportunities that are adequate for students' needs, and something has to be done about it.

I do think that the education television system which has been proposed, the network, has so many assets and so much potential that it is unthinkable that it should not be given favorable consideration.

We have looked at—some of us in my area have gone out to New York and looked at some of the programs that exist in Bosy Centers out there. They come in different sizes and packages. The fact is that they are working well there. And I think that something similar to it might work well in Massachusetts.

I would issue one further request, and that is that when it is being planned—and I am speaking not so much to the technology as much as to the programming—that people from the grass roots of education, public education particularly, be involved in the program planning.

If the system is to serve students, then I think that public school people and teachers need to be involved in what kind of education that should be.

If it is to serve teachers, then I think that teachers themselves have some very definite ideas about what kinds of education they need, and they may not always be in sync with what the colleges feel is appropriate.

So I feel that the grass roots involvement in planning is very important. But, regardless of that one caveat, I strongly urge that it be given favorable consideration.

The CHAIRMAN. Let me just ask you, you had indicated some of the courses that had been dropped over the—are you talking about the last five years, 10 years, that kind of thing?

Mr. BATCHELDER. And ongoing.

The CHAIRMAN. And can you make that available to us?

Mr. BATCHELDER. I am sorry. What I brought are the courses that remain. By implication, what is not there——

The CHAIRMAN. Well, can you just make a general comment whether the areas of math and science and physics and chemistry have been—has there been special pressure on those courses?

Mr. BATCHELDER. Yes, absolutely. As I say, whenever a school system is facing a potential economy, they start looking at what courses can be combined or, in fact, what courses must be eliminated.

The ones which have the lowest incidence of population are the ones which are the most suspect. Therefore, they often do get discontinued, and that has happened, particularly in levels, so that everything becomes compressed into a small group.

In one case, and it is not—as I said, it is not just a question of the smaller schools. The Town of Easthampton has a high school of 660 students. They are facing some of the same problems. They have no advanced placement courses.

Their resolution of that one for students who are looking for it are similar to Andy's. Only in that case they say, "Go down to Holyoke Community College, get a course in physics, get a course in chemistry, if that is what you want, and good luck to you." But there is no funding for it, and there is no transportation for it, so it is pretty much left up to the individual student to do it. That is not equality of opportunity.

The CHAIRMAN. Mr. McDonald.

Mr. MCDONALD. Senator, with no inference about your ability to speak in public, the last time I saw you speak was in 1966 at Bridgewater State College. I was reminded of that this morning when I saw the students coming in here.

I was, at that particular point in time, 1966, one of about 70 students at Bridgewater State College involved in a program leading to a degree to teach Social Studies at the secondary school level.

One of the things that we see in our area is that Bridgewater State College has not graduated any secondary school teachers in the field of social studies in a number of years.

At our administrative council meetings in Middleborough, one of the things that has come up a number of times is that there was a period of years that we had no student teachers at the secondary level at all.

And Middleborough is a progressive school system in our area. And for a long period of time we had been receiving requests from student teachers in our area and outside of our area to come and student teach there.

I bring that forth because you are talking about math and science as areas in particular, but I think there is obviously a movement away from people in all areas of education.

Last year, we had a position open up for a computer teacher at the secondary level. We put out newspaper articles to that effect, and we contacted some 15 universities in this area and still received no applicants for the position.

So we had a brand new lab with about 14 new computers in the lab, and a number of students who had signed up to take the course who had no teacher and, in fact, stayed in a study hall for several months while we tried to fill that position.

As the Chairperson for a Computer Collaborative in our area that represents about 21 towns, I know that our situation is not unique. One of the things that has come up at our meetings is, from other towns, a similar type of situation.

The CHAIRMAN. Why could you not get someone? What is your failure to do so?

Mr. MCDONALD. I, at one point in time, went over to Bridgewater State College to talk to some of their computer science majors—who had, at that point in time, no job offers, but were very close to graduating. I said, "Look, we are in a situation. In the very near future we are going to have positions opening. Would you apply for those positions?" And they said no. And I said, "Well, why wouldn't you?"

And they said, "Well, why should we? We can go into industry and make $10,000 more to start than you're going to give us as a teacher. And we won't have any of the hassles that are involved in teaching."

So, that was their answer to me.

So that is a problem, obviously, that we are facing at our level.

Roxanne is a former student of mine. Not that I am that old and she is that young. But she attended a telecommunications network or conference down in Cape Cod that I was asked to put on by the State. And Roxanne has, since then, gone and done a number of things in the field of telecommunications using modems and transmitting between school systems with her students and so forth. And she has made quite a name for herself. And, in fact, we now have people in our community who are requesting to go up and see Roxanne and what she is doing at her school.

And my suggestion is: when you have talent like that, would it not be nice if there was a mechanism or a vehicle, as they are trying to put forth, where that type of person could then present materials that would be available to all of the high schools in our area without our teachers having to go up there.

The CHAIRMAN. Do you think that some of the teachers would take courses to be able to instruct in this area? Would they take advanced instructions?

Mr. MCDONALD. I think we have situations where we have students who would, and we have students who have gone beyond a level of expertise, perhaps that we can offer them at this point in

time, who could take advantage of this. And we also have teachers, yes, who would be interested in doing that.

As Roxanne mentioned her difficulty and quandary as to what to do to gain knowledge, I was going to Harvard for an advanced degree and found it very, very difficult if you are talking about this type of degree in computers.

I had to go in twice a night for a particular course. And in order to get in the lab, or get time on the computers in there, I would have to go in and spend an entire day on a Saturday, and perhaps one other night in order to get in the course work.

Well, that is a tremendous commitment on the part of a teacher. There ought to be another vehicle or mechanism to do that.

Roxanne mentioned the type of commitment that she would have to make.

I had a friend of mine who was a teacher about three or four years ago, leave the profession. He was a math teacher. He said, "Joe, I was offered between $10,000 and $14,000 above what I'm making right now."

Because of his field, he was dealing with computers. The computer company—he said he wanted to do some work at home—they gave him a computer to take home with him. He had to ride the bus into Boston. They bought him a lap top computer so he could use it on his bus ride into Boston.

Yet, we have teachers who obviously would like to get involved and like to learn more, but there is no mechanism for us in our school system or any that I know of, to provide those types of incentives to teachers.

The CHAIRMAN. How many students do you think would take the computer instruction if you could offer it at the Middleborough High School?

Mr. MCDONALD. My high school principal has suggested to me that just about every student in the school would like to. But we are not capable of offering them.

The CHAIRMAN. All right. Fine. Thank you very much. Very, very helpful.

The next panel, Dr. Lincoln Lynch, who is the Superintendent of Schools, Middleborough, and President, New England Association of School Superintendents; John LeBaron, who is the Director of Bureau of Educational Resources, Mass. Department of Education, and Executive Director of Massachusetts Executive Committee for Educational Television; and Dr. Russ Jones, who is the Vice President for Academic Affairs, Boston University, and Chairman of the Task Force on Use of Educational Technology, Former Dean of the University of Massachusetts School of Engineering.

Good morning.

We will start off with Dr. Lynch.

STATEMENTS OF DR. LINCOLN LYNCH, SUPERINTENDENT OF SCHOOLS, MIDDLEBOROUGH, MA, PRESIDENT, NEW ENGLAND ASSOCIATION OF SCHOOL SUPERINTENDENTS; JOHN LeBARON, DIRECTOR, BUREAU OF EDUCATIONAL RESOURCES, MASSACHUSETTS DEPARTMENT OF EDUCATION; EXECUTIVE DIRECTOR, MASSACHUSETTS EXECUTIVE COMMITTEE FOR EDUCATIONAL TELEVISION; AND DR. RUSSEL JONES, VICE PRESIDENT FOR ACADEMIC AFFAIRS, BOSTON UNIVERSITY; PRESIDENT-DESIGNATE, UNIVERSITY OF DELAWARE; CHAIRMAN, TASK FORCE ON USE OF EDUCATIONAL TECHNOLOGY, AMERICAN SOCIETY FOR ENGINEERING EDUCATION; FORMER DEAN, UNIVERSITY OF MASSACHUSETTS SCHOOL OF ENGINEERING

Dr. LYNCH. Senator, I am going to put aside my prepared remarks, which I will leave for you with the staff, because I have taken a page of notes since I have been sitting up there, and I have some issues I would like to address.

I served seven years as principal out in this area, the Berkshire area, principal, teacher, before going assistant principal of Pittsfield. For the last 19 years, I have been Superintendent of Schools right here, in Middleborough.

I am also President of the New England Association of School Superintendents, 670 members strong. You were kind enough to address us in Hyannis——

The CHAIRMAN. That is right.

Mr. MCDONALD [continuing]. A year ago. And I got a call from Calais, Maine, which is right in here, from Dr. E.A. Marks, Richard E. A. Marks, from Calais, Maine, yesterday, asking me for all the information I could provide on the MCET Program because the University of Maine is beginning to look into the same kind of a project.

I explained that we are very interested in networking. And I would like to give you some of the reasons, the practical application, from a superintendent's point of view.

The most important thing I do, my essential function is to provide the best education I can to my youngsters within the resources available to me. And that includes personal and material resources—personnel.

And, like you, I build my—the quality of my function, or the quality of my effectiveness, is determined by the quality of staff I have around me.

And if Joe described the anatomy of our search for a computer teacher, he ought to try to find a physics teacher.

I think three of the essential qualities of—elements of instruction, other than the material that goes in the curriculum, is the motivation of the students, the time on task, and the quality of the instruction.

My average teacher is—90 percent of my teachers right now are on maximum, which means I have an aging of staff. It is a problem we have particularly in Massachusetts since Proposition 2½. And a lot of our young blood, our ambitious, creative, young people were knocked out. And they have not been able to reenter the field because of a shortage of teaching positions.

That means I have the obligation to retrain the people I have on staff. This retraining requires constant updating and upgrading our in-service training. In many cases that is not possible except through programs such as the math and science grant that you people put through Congress, and which we had this year.

When that money filtered down to me, I got a measly $2,700 to spend on in-service training for math and science teachers. I could do a hell of a lot more with that kind of time off a telecommunications network getting some of the best people in the country beamed into my school for my teachers. I cannot do much on a local level with $2,700. So I think it is a much more efficient use of in-service training funds.

I have a chance to upgrade the training of my current staff. I have a chance to use my younger teachers to present technology and new ideas that are well beyond our present capability.

The other problem I have is students like Jonathan Osborn. I have my Andy Turner too. Jonathan is up against the top level of our ability to present courses to him.

Now we have arrangements with Bridgewater State College through President Gerard Indelicato, and through Southeastern Mass. University, to send our advanced high school students down there.

But we are talking about an hour and a half travel out of their day in addition to their high school day.

We have programs for gifted children through Project Spotlight, which is funded by the Board of Regents, and provides something for our advanced students. But a boy like Jonathan Osborn is up against the knowledge limits of our instruction and we are sending him to the Boston Science Museum for advanced instruction on Saturdays. And, indeed, he in turn is coming back and working for a private computer company training teachers.

That shows you the paucity of instructional capability that is out there. And it is very, very difficult for us to find instructors.

These then are some of the points that I would like to make. Cheaper, more efficient, more effective ways to provide training have got to be provided. If we are to increase the quality of education available to our youngsters, we have to provide quality of the instruction available to them. And one of our biggest problems is updating the in-service instructions of our professionals.

I also have a Russian teacher who is probably the best Russian teacher in the whole of Massachusetts, if not the Northeast. His name happens to be John Edward Sullivan. He was trained in Monterey. Nevertheless, he is an acknowledged leader in the field of foreign language. I could share him with other schools or colleges. I in turn need a Latin instructor. I have had to drop Harvard physics because I no longer have an instructor that can handle it.

So we have gone from two levels of physics to one level, to traditional physics, and Harvard Project Physics we which had to drop because of the unavailability of trained personnel.

Now, if we could share these teachers live and taped presentations, how much more effective and extensive our instructional offerings would be. That is why we, the superintendents of the New England Superintendents Association, have agreed unanimously

that we would support this kind of Educational Telecommunications effort.

The CHAIRMAN. Do you think the students are there to continue to take those courses?

Dr. LYNCH. Yes, sir. No question about it. They are there. And we cannot make it available to them.

We open up our——

The CHAIRMAN. And do you think that the teachers have desires to upgrade their skills as well?

Dr. LYNCH. There is no question about that either.

And it is much easier for them to do it on a local level, and to do it through teleconferencing or telecommunications, than it is to travel the 28 miles down to Southeastern Mass. University to take "in-service" courses the quality of which is sometimes suspect.

I do not say that is universally true, but I am saying that if we can train teachers on a regional level, we can assure we get the top people in the country or in the East.

The CHAIRMAN. All right.

Mr. LeBaron.

Dr. LYNCH. I think the top people are in the East.

The CHAIRMAN. That is right. I wish you were a little more enthusiastic about this.

Dr. LYNCH. Well, any relation between what I have said and my prepared remarks is coincidental.

Here are my notes. You have got me going this morning, Senator, and I appreciate the opportunity to contribute.

[The prepared statement of Mr. Lynch follows:]

tec

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February 28, 1987

The Honorable Senator Edward M. Kennedy
SR-113
United States Senate
Washington, D.C. 20510

RE: Public Hearing on Telecommunications
in Massachusetts
Bunker Hill Community College
Charlestown, Massachusetts
February 28, 1987

Dear Senator Kennedy:

Thank you for providing this opportunity to discuss with you the growing importance of Telecommunications Technology to the current and future growth and development of Massachusetts.

Today, I represent The Education Cooperative, TEC, a regional consortium of twelve West Suburban communities. As you are aware, West Suburban Boston has a well established tradition of pride and excellence in its public schools. Articulate and concerned parents have invested in and molded responsive institutions offering both breadth and depth of program for all students. With strong majorities of college-bound clients, strength in prerequisite collegiate academics has been expected but not at the expense of quality business, occupational and special needs programs.

With a combination of declining enrollments and Proposition 2½ fiscal limitations, this spectrum of instructional opportunities, historically presented to all students is rapidly shrinking. There is a growing data base that conclusively demonstrates that our ability to maintain a comprehensive secondary curriculum is being seriously challenged by increased class size, course combinations and reductions and scheduling limitations.

Cable, microwave and satellite telecommunications provide the vehicle for neighboring high schools to share instruction. Closed-circuit television systems of the 60s proved usable but ineffective as a practical instructional tool because of little interactive capability. Today, full program broadcast and reception can be simultaneous with both audio and video interactions. This technology is available and would provide a spectrum of instructional options at a time when enrollment decline and financial limitations will challenge West Suburban comprehensive curricula.

Neighboring communities using telecommunication systems would be able to maintain and refine low incidence academic instruction (class size 2-8) by teaming with a TEC community providing select low incident courses. Students would attend "conferencing sites" in their high school, departmental or separate, and would fully interact with a neighboring French IV, Russian History, A.P. Calculus class. These discussion-sized rooms would be equipped with viewing monitors, derome connectors, and possibly automatic cameras that would provide two-way audio and two-way video interaction. A long-distance instructional capability could preserve 20-25% of our secondary curriculum, provide unique program development opportunities when the budget of one community would not limit growth potential, and provide a new dimension to instructional enrichment that we can only fantasize through our experience with the best in current public broadcasting.

On a broader scale, Public Schools face times of unprecedented challenge and opportunity. The challenges include offering a comprehensive curriculum that keeps pace with the world's rapidly expanding knowledge while serving a declining school-age population. Quality educational opportunities must remain available and expand while resources to make this possible are diminishing. (1) Rural communities must find ways to guarantee equitable educational opportunities. (2) Communities must find ways to expand their instructional delivery capacity to include low incidence instruction. (3) All communities must prepare, now, for an impending teacher shortage and during this era of private enterprise, those in public service must all discover and apply greater cost-to-scale efficiencies.

In response to such challenges, education leaders in the West Suburban Boston area of Massachusetts are seeking to establish a cooperative cable network that enables school districts to share instructional expertise with each other.

The network is designed to serve a number of purposes:

1. Enable Low Enrollment Courses, such as certain foreign language, literature, and history courses, to continue to be offered.

2. Enable High Enrollment Courses to create an additional section when student interest exceeds manageable size, e.g., 25 students.

3. Create Advanced Placement, college-level course opportunities, such as calculus and college writing.

4. Promote new models of In-Service teacher and administrator training, to improve the quality of instruction and modify the nature of the teacher's role.

5. Share Special Occasions such as arts performances, speakers.

6. Share Superstars, when a school district has an outstanding teacher.

7. Encourage New Courses, such as microbiology or meteorology, which would not otherwise be available.

8. Develop Data Sharing, for evaluation and research in longitudinal studies, such as drop-out prevention.

9. Explore Real-Time Data, involving the collection and sharing of data to spur study of global issues such as weather patterns, whale migration, acid rain.

We are concerned that this exploration build on what is already known about effective television instruction and interactive learning. The following principles serve as guidelines in setting up the classroom.

1. Instructional success depends in the technical quality of audio and video signals.

2. Interactivity between students and teachers must be emphasized to mitigate loss of direct teacher contact.

3. Occasions should be planned to promote feelings of cohesiveness and involvement among participants at all sites.

4. Teachers and students should demonstrate enhanced communication skills, i.e., through questioning, answering and discussion behaviors.

5. Effective instruction emphasizes visual and aural organizing cues for learning.

6. Methods of teacher supervision should promote the responsibility of students for their own learning.

7. Instructional planning involves timely distribution and collection of materials.

At this time, we need financial and technical support to assist our state and local planning. Specific technical needs are paramount. Determining the technical options for developing interactive capacities in schools is critical. We also must examine how to expand our current instructional delivery system to better accomodate this technology. We must do a better job at creating environments for experimentation and change. We must also secure adequate funding to nourish these hypotheses and together to accomplish our purpose.

My appreciation to you for this opportunity.

Cordially,

Roger W. Ritch
Executive Director

RWR:js

The CHAIRMAN. Okay, John.

Mr. LEBARON. Thank you.

Since you have not used your prepared remarks, I wonder if I can borrow them.

I direct Massachusetts Educational Television, a unit of the Department of Education for the State. And our history is the provision of the school broadcast service, whereby curriculum enrichment materials are broadcast to schools statewide through to PBS stations.

We have moved—we have not moved away from that, but we have moved beyond that in recent years in ways that suggest a need for the kind of telecommunications facilities that are being proposed by MCET.

One of the reasons for this is that the materials that we distribute used to be broadcast on a fixed schedule in a way that was not convenient for teachers to use because the materials were presented to them at times that did not correspond to their activities in those topical areas and their curriculum.

So we have moved toward a video cassette distribution service that has duplication and a lending library component to it.

And as an indication of the demand for those kinds of more flexible services, when we started out in fiscal 1983, we did a volume of business that was about $1,700, rather small.

The CHAIRMAN. Just before, could you tell us just a little bit about the whole program, the Educational Television Program?

Mr. LEBARON. Yes. It is a program that broadcasts on WGBH and WGBY during the school day and during the school year. It consists of about 1,000 programs every year.

It broadcasts from 10:30 to 2:30 during the day, and it is basically used by schoolteachers to enrich their curriculum, not course work as such.

The CHAIRMAN. And tell us a little bit about the degree of acceptability and interest and the reaction that you have had from teachers and students.

Mr. LEBARON. It has been substantial. The last survey we did was at the secondary school level, and we found out then that roughly 85 percent of the secondary schools in the State use the programming in one way, shape or form. We are doing another survey right now.

The video cassette services, which have more marketplace data attached to them, have increased by a factor of 10 since we started the service four years ago.

The $1,700 I referred to earlier has grown to $17,000, and we are still wrapping our cassettes in brown paper parcels and sending them out by mail. And clearly we need some kind of a mechanism that allows us to do that delivery more efficiently.

The CHAIRMAN. You are suggesting that there is a great thirst for this kind of information, this kind of education among the schools?

Mr. LEBARON. There is no question about it. There is no question about it.

We, just this year, have started a competitive grants program that several people in this room know about. The grants program

has $500,000 attached to it. It is for the adoption of technological practices for school districts.

We received roughly 150 proposals for only 29 available grants. That is $2.5 million asked for, only $500,000 available. That is certainly related to the kind of demand that MCET proposes to address.

Dr. LYNCH. Can I tell you the kind of project that was affected by that because mine was turned down?

The CHAIRMAN. I think I am going to hear about it. Is this in your formal presentation?

Dr. LYNCH. With our proposed three high schools and three junior highs, connected by a telecommunications network to Bridgewater State College we could compare and exchange resources and information, unpublished resources, and material available at the State college level to advanced students that is the kind of linkages which were included in this package. Because of a lack of funding, it was turned down. All of that could be accomplished through this proposed bill.

Sorry to interrupt.

The CHAIRMAN. That is all right. Any time.

Mr. LEBARON. Roxanne had a proposal incidentally that was not turned down. We have both sides of that spectrum here.

The CHAIRMAN. Let me ask you, Mr. LeBaron, about what your projection of the demand in the future is. Have you done anything on that? How much additional desire would there be, do you expect, from your own educational program?

Mr. LEBARON. Well, I think that the increase in demand will manifest itself in different and more sophisticated formats.

We are getting involved in distributing computer software now and distributing interactive video computer materials. And we have been doing that for the past three years.

Virtually every school district that has had a need for grade levels of materials that we are distributing have ordered those materials.

Again I think that we are going to need a rather sophisticated electronic delivery system to accommodate the different varieties of format that a computer video text package would embody beyond what is required for simple video transmission.

Demand is increasing, and the demand for more sophisticated materials is increasing also.

The CHAIRMAN. Do you get letters or communications from teachers and students?

Mr. LEBARON. Yes, we do. We have got—the major form of communication is phone calls.

If, for example, the tower goes down at WGBH, we do not have access to communication with the outside world at all because teachers are ringing the phone off the hook.

The CHAIRMAN. It is difficult to quantify that type of comment, but what we are trying to do is make a record here of the desirability for these kinds of services.

And I gather from what you said that there is a very substantial one, in terms of both students and teachers.

Mr. LEBARON. Yes. By way of quantification, we have a software video package that addresses problem solving at the middle school level.

Of all the middle schools in the Commonwealth that could have ordered that, more than 90 percent did.

When we have a good product that is available to schools, it is generally asked for.

The CHAIRMAN. Okay.

Mr. Jones.

Dr. JONES. Good morning, Senator.

The CHAIRMAN. It is nice to have you here.

Dr. JONES. As you mentioned in the introduction, I have served as Dean of Engineering at the University of Massachusetts, and am now Academic Vice President of Boston University.

One of my primary motivations in both positions has been to try to keep the work force of the Commonwealth of Massachusetts up to speed so that we can compete internationally.

The dilemma, of course, is that technology changes very rapidly. And while we have superb computer engineers, electrical engineers, and electronic experts working in the 128 belt, we find out that they become obsolete at a fairly high rate if they do not continue their educations.

What the University of Massachusetts, Boston University, and other schools in the area do currently is deliver course work to those highly-trained technical people in their workplaces.

We have put in place what I would call scotch-tape and bailing wire systems.

My former colleagues at the University of Massachusetts used to have mail drops at drug stores, where they would drop a videotape off and an engineer would pick it up at night on the way home.

We at Boston University currently use an ITFS broadcast link off the top of the Prudential Center. We can get out to about 40 or 50 miles, and beyond that point we are silent, we cannot reach the industry.

The kind of system described here would give us the opportunity to reach out wherever the worker in the workplace needs upgrading. Clearly, somebody in Worcester, Massachusetts, or Pittsfield, Massachusetts, cannot drive to Northeastern University or to Boston University, fighting the city traffic, and pick up an education that way.

I recently completed last fall a study on the utilization of technical people in the United States, one that was funded by the National Science Foundation and the Department of Defense. One of the key findings was that this need for continuing education is a major national crisis.

As you well know, there are educational systems around the world, particularly in the Pacific rim, where education for individuals is much more readily available, particularly in the math and science areas, and we have simply got to be able to catch up.

It may be interesting for me to point out that we have many models of how this kind of educational technology works.

The delivery of video courses is being done currently. It simply is not being done as extensively as one might like.

A typical electrical engineer working in the 128 belt can have a choice of three or four courses, for example, in very large scale integration design. A typical math teacher in Massachusetts, however, simply does not have that availability. A typical science teacher in Massachusetts does not have that opportunity.

As I look at your chart showing the gap between supply and demand of critically needed teachers, I am afraid that the bar on the left and the bar on the right are going to get further apart, rather than closer together, within the next couple of decades.

The School of Education at Boston University has gone from about 660 freshmen a decade ago to about 50 freshmen last fall. There simply are not the bright young people going into the teaching field that are going to close that kind of a gap, and particularly in the areas of mathematics and science. The bright young girl who used to go into teaching is more likely going to become a computer scientist at this point, and not going into teaching. Those gaps are not going to be closed for a long time.

I believe that we are going to have to use the technology to multiply the good teachers we have and get them out in many more places.

The CHAIRMAN. What was that figure that you gave about the 50 and the 600? Could you give that to me again?

Dr. JONES. Our School of Education at Boston University had over 600 freshmen a decade ago, and this past fall it had on the order of 50, a tremendous decrease in the number of students coming into the education field. And that decrease is felt most heavily in the math and science areas.

I should tell you that the video and computers that would be useful over the kind of network that MCET is proposing here will get extremely high utilization.

The "Sesame Street" generation is growing up. I have a couple of young children, ages seven and 10, for whom video and the computer are good friends. My 10-year old daughter thinks nothing of sitting down at her computer on an afternoon, after she has finished her homework, and going through some drill and practice in mathematics, some drill and practice in graphics, or some word processing where the computer challenges her to write better compositions. It keeps throwing new problems at her.

That kind of opportunity can be multiplied in our public schools, and the young people are ready for it. They are used to this technology. It is not something strange or foreign to them. It may be foreign to many of the people of our generation at the front of this hearing room. It is not foreign to the "Sesame Street" generation.

So I think that there is a receptivity, that the time is right.

I am going to leave for your staff a report that a committee of us just finished in late 1986, looking at the quality of education for technical people, for engineers. We were asked to take a look at whether major investment should be made in video, in computers, for educational purposes; the kinds of technology being proposed here today.

The basic conclusion of this report is that the time is right. The teaching machine, or "Star School" as you put it earlier, is a concept whose time has come.

We might not have been ready a couple of decades ago. The technology is certainly ready today. The need is certainly very appropriate today.

My faculty colleagues at the University of Massachusetts, a decade ago when we first started sending video courses into the 128 belt, felt that they needed to multiply themselves. One electrical engineering faculty member could not deal with the several hundred engineers around the 128 belt and local locations that he had to deal with, so he electronically multiplied himself.

I think we have that same opportunity now for the math and science teachers, and others in the high schools—language teachers perhaps—where there simply are not enough good teachers to go around. We have to electronically multiply them. And I think the system proposed here today will do that.

The CHAIRMAN. Could you tell a little bit about using this kind of a technique in education.

I think there are probably many Americans who think that it is essential that you have that hands-on presence of both the teacher and the classroom. I think most of the people have gone through an educational experience of that nature.

What can you tell us about the ability to learn? What has been the experience in the fields of education in terms of using computers and using television? I would be interested in hearing your comment on that.

Dr. JONES. It is very clear that you have to keep the teacher in the loop. One cannot go to a totally canned package and expect it to work. If the pacing is not there, if the motivation is not there, if the interactivity is not there, good education is not going to occur.

I will also leave with your staff a description of the video program we currently broadcast from Boston University where the teacher is in the loop.

If the teacher sits in a classroom, not unlike this, the entire goings-on in the class are captured: the interaction with students in the class, graphics that may be put up on the board, a computer where a demonstration may be done, a clip of videotape from a laboratory experiment. All those can be run into the video transmitted over in our case, the ITFS link or, in the future case, a satellite, and delivered into the remote site.

The engineer at a computer company on the 128 belt walks to a conference room at 3 o'clock Tuesday and Thursday afternoons, and that show is there. But it is a live teacher who is running the show. That student has the opportunity to phone in questions, have interaction. The engineer has the opportunity to tape record that presentation, so that if one of his colleagues is out of town that day, that colleague can catch up the next morning.

The technology in terms of teaching, in terms of having the student learn very readily, works as long as you keep the teacher in the loop.

The CHAIRMAN. Mr. LeBaron, Dr. Lynch, do you subscribe to that too?

Mr. LEBARON. Absolutely.

Dr. LYNCH. I certainly do. I think interaction is absolutely essential. I think that it is particularly important when you are dealing

with retraining teachers and with training—students in any educational program you wish to be effective.

Dr. JONES. Senator, I would like to make a comment about geography, if I may.

I am in the process of moving from Boston University to another institution. Yesterday, I took off my Terrier pin, and I was provided with a Fighting Blue Hen from the University of Delaware, where I will become President in July.

I would like to see Massachusetts move very rapidly to implement this because I believe it will be a model for what I would like to do in Delaware over the years ahead.

Having a successful program here, where there is a lot of potential, would certainly assist me in being able to go to my legislature and my Senators, and get similar support in my new location.

The CHAIRMAN. Well, I will tell Joe Biden all about it.

Seriously, we are very hopeful of being able to implement this expeditiously and then to be able to, hopefully, replicate it.

Our Human Resources Committee, with Senator Pell, Chairman of the Education Subcommittee, and Senator Stafford from Vermont, and a number of others, Senators Dodd and Weicker on our Human Resources Committee, New England is very strongly represented.

And I know that many of them are interested in this proposal and, hopefully, if we do it right, do it well up here, we are going to be able to have an important replication of this in other parts of the country.

So that is clearly our intention. But we have to certainly ensure that we have it established in our region, and have it supported in the region and have that kind of interaction from communities within the region.

That is probably a pretty good point to hand to our last panel.

Dr. LYNCH. Senator, you mentioned the Education Committee. Could I just make a pitch for the fact that the Educational Consolidation and Improvement Grant, Title 2, has been largely responsible for us being able to get the computer hardware that we have needed because of the fiscal pressure, particularly in Massachusetts, fiscal constraints, imposed by Proposition 2½.

The Block 2 grants have enabled us to equip three computer laboratories.

In our typing lab, for instance, no longer do we have manual machines in Typing I. We have electric and electronics in Typing I. All of our Typing II is done on word processors.

And we have been able to do that through the ECIA Block 22 grant, which, although it has no constituency or group of people cheering for it, is most effective in improving our technological capabilities.

The CHAIRMAN. Well, the good news is that it has not been targeted for reduction by the Administration. And I feel confident that will probably be—it will either end up there or, hopefully, be somewhat higher.

Dr. LYNCH. Thank you.

The CHAIRMAN. Okay. We will have our final panel here.

Dr. Coor is the President of the University of Vermont. And Dr. Crocker is the Dean of the Continuing Education, the University of

Rhode Island, and Chairman of the Rhode Island Education Cable Council.

And we want to thank Dr. Coor and Dr. Crocker very much for joining us. I know that Senator Stafford would want me to extend his good warm welcome. I think all of us on the Human Resources Committee are very mindful of the very substantial leadership that he provided during the time he was Chairman of the Committee, and the very strong working partnership that we have worked out on our Committee generally.

So we are very glad to have you here, and we know that the University of Vermont has been very much involved in the planning of the MCET. So we would be interested in how someone from that vantage point views this. And then we will hear from Rhode Island.

STATEMENTS OF DR. LATTIE COOR, PRESIDENT, UNIVERSITY OF VERMONT; AND DR. WALKER CROCKER, DEAN, COLLEGE OF CONTINUING EDUCATION, UNIVERSITY OF RHODE ISLAND, CHAIRMAN, RHODE ISLAND HIGHER EDUCATION CABLE CHANNEL

Dr. COOR. Thank you very much, Senator.

I join in that spirit on behalf of Senator Stafford. Even though the Ides of last November caused his position to be one in the minority, we know that his interest in education in general and his very close working relationship with you and the New England delegation in Human Resources has been a very significant thing for all of us.

My colleagues and I in higher education feel that very strongly. It is a pleasure, as well, to see it work so well under your leadership today.

I will speak regionally because that, to me, is one of the most significant features of the MCET plan.

With Massachusetts taking the primary role, as we feel it should, not because of any particular intellectual dominance, I would suggest, Senator, but simply because its size——

The CHAIRMAN. We will go to the next witness.

Dr. COOR. I note, in placing the heart of this in Massachusetts, as we believe it should be, that the satellite on the map presented today hovers over Vermont, as it seeks to radiate to the other parts.

I speak for myself today, but I do want you to know, Senator, that my colleagues in the other State universities in New England have a similar interest in this program.

The President of the University of Maine at Orono, Dale Lick, would have hoped to be here today, as indeed would Gordon Haaland, President of the University of New Hampshire.

And all of us, working through our New England State University, Council of Presidents, have been involved with and are very much interested in this concept.

Maybe the best way that I may comment for you and for the record on the regional value we see is to describe how a small rural—distinguished, of course, but rural—State can participate actively in this program.

Our example, in fact, may be particularly poignant, not only as it works here, but as it serves as a model for other parts of the country if this concept works as well as we expect.

We are, as you know, the smallest New England State. With Alaska growing and Wyoming now pushing us, I think we are on our way to being the smallest in the nation.

We are rural, the most rural. And we have a geographically inhibiting set of qualities.

Conventional contact, including educational contact, is made as difficult in our setting, especially this time of the year, as one could find anywhere.

The University of Vermont's statewide educational television network, for example, requires four transmitters and two translators to reach an audience much smaller than WGBH reaches with one transmitter in the Boston area.

Yet, even though we are rural and small, we have seen substantial changes in the last decade that make us as attentive to high technology and to modern educational capacity as if we were a major urban area.

Vermont now ranks third in the nation in the percentage of its work force in high technology industry, as part of this general renaissance in New England, where we now have to find more effective ways to reach all of those audiences that historically we have had to reach in conventional means.

Maybe the best example I can give of efforts we have made to date, but opportunities we think that could work for the future, is our tie with Maine in our medical school.

Maine has no medical school. It is under contract to the University of Vermont, and has been for years, to provide training for its State residents.

The Maine Medical Center in Portland is a teaching hospital of the University of Vermont, and we have rural clinics throughout Maine that are staffed by medical students in rotation, resident physicians that are also doing their resident training, and practicing physicians in continuing education.

We have found over the years a variety of ways to make those links conventional using teleconferencing in the more primitive ways it has been available. But we see now, through an example like this, ways to tie our medical school and all of the continuing education activities that exist, as if they were in our own immediate vicinity.

Vermont has, over the years, been particularly interested in effective telecommunications links, and virtually every conventional telecommunications capacity that has been developed, we have used.

Two major statewide studies have confirmed that we should expand our conventional techniques, mostly fiber optic, land based, not only to reach schools, as I know you have heard here today, but also to provide links for college to college. There are 23 colleges in Vermont as well as continuing education and off-site degree work.

We know that much technology is possible and affordable, but we know this technology would not be wise for us.

It would not be affordable. We could not begin to use the capacity that is there. And we know, from all of our conversations with

the leadership of MCET, that the technological capacity based here, affordable for a user like us, where we not only can originate programs but can use the capacity and the programs developed elsewhere, provide that piece to our existing and prospective future conventional telecommunications connections that we alone could not, would not, and should not afford.

At every stage along the way, MCET has made it clear to us that, while Massachusetts based, it views the region as its audience and has encouraged these conversations as they have gone forward.

The uses already in Massachusetts would be uses we would like to see in our connection: elementary/secondary schoolchildren, teacher education in a continuing way, and industrial and professional training.

There is one special feature I shall mention in closing my formal remarks that suggests why there are particular regional variations that also offer interesting promise on a national basis.

The communities in Vermont are very small. For the University of Vermont to provide conventional off-site degree programs is not cost-effective.

We have recently, for example, had to close an effort at providing a masters in business administration in Rutland, Vermont, our second largest community, simply because there are not enough people there for us to send faculty in a conventional way.

It seems, therefore, that the kind of degree programs available in more populous settings, or in States that have more conventional features, we simply cannot afford.

This technology, coupled with the other efforts that we have been doing, would provide, in that sparsely settled setting, degree work and continuing education work that we simply could not do otherwise.

In short, while we have capacities and interests, this is nothing we could or should do on our own. That is why we are particularly keen about it.

The CHAIRMAN. Thank you, Doctor.

Let me just get back to other questions, but you were here when we were inquiring of our other panels about what are some of the real-life situations that many of our elementary and secondary schools are faced with here in the Commonwealth, in terms of courses and course availability. You heard from some students here as well.

Would you feel that Vermont has a similar kind of a profile in terms of the needs for students to be able to access certain courses and for additional kinds of training opportunities for teachers, as well as for the burgeoning higher tech industries to be able to have access to additional training?

Was that profile that we heard in general fairly much in evidence in Vermont as well?

Dr. COOR. I am sorry, Senator, that I was not here. I just arrived minutes before I stepped on to the panel so I do not know exactly how that profile was described.

Maybe briefly I could describe two or three situations that would bear in Vermont, and perhaps would have a tie to that panel itself.

At the higher educational level, we have no community college that has its own building—none. The Community College of Ver-

mont is a system that uses local facilities. It is a campus without walls.

As a result, while it offers fine courses, there are real limits to those courses being within access of residents. There is no capacity that you have in this metropolitan area, or that many other States have.

So the physical access to a setting where courses are available is very limited. This obviously offers a capacity that I suspect was described by some of your earlier witnesses we would not otherwise have.

Secondly, while Vermont has consolidated its high schools a fair amount, we still have high schools with 80 students, 90 students, 10 or 11 of whom will go to college.

When those students enter the University of Vermont, the limited number of courses they have had in mathematics, in science, in language, in programs that a tiny high school could not offer, puts them at risk academically. Often we have to provide some bridge to supplement those courses to even make them eligible for admission.

Access through this kind of technique obviously would be of value.

A third example that may fit what was described by earlier witnesses is that we have had fascinating and successful programs that have involved teachers throughout the State.

The Vermont writing program is one of the best examples, where individuals have participated regularly in sharpening, as teachers, their own skills at writing and, through it, their own capacity to better teach other students to write.

One of the keys to that process is for them to stay in touch with one another and to work regularly as if they could all be drawn together. Very substantial capacity would be offered here.

The CHAIRMAN. Thank you.

Dr. Crocker.

Dr. CROCKER. I have a different color name badge, Senator, because I understand the Commonwealth likes to keep track of Rhode Islanders who come into Massachusetts. And I hope to show you that I come with good intentions.

The CHAIRMAN. Well, it is still an open question. We want to hear whether you support our program.

Dr. CROCKER. Actually, Rhode Island is atypical in this arena, in that I am representing all 10 institutions of higher education. I can speak with one voice for all of the institutions in Rhode Island who are members of the Higher Education Cable Council, and that is the total number of Rhode Island higher educational institutions.

I would like to give you a three-minute prepared statement because, when you are representing 10 colleges and universities, you do not want to be guilty of misrepresenting them. And I want to be sure I can tell them when I return to Rhode Island, that I have carried the word as they finally agreed they would like it to be carried.

I think it also sums up, because I have been here for all of the testimony, I think it sums up quite a few of the points that were made this morning. And I think there are one or two maybe new wrinkles that you might find useful.

I come before you as the Dean of a fair-sized continuing education unit at the University of Rhode Island. We serve between 15,000 and 20,000 people a year, in a host of experiences.

I also speak to you as the Chair of the Rhode Island Higher Education Cable Television Council, a confederation of all institutions of higher education in Rhode Island, plus several affiliate groups, such as the Rhode Island State Department of Environmental Management, Rhode Island State Department of Health, the Institute for Labor Studies and Research, the Rhode Island Occupational Information Coordinating Council, among others.

It is perhaps as Chair of the Rhode Island Higher Education Cable Television Council that I might provide more relevant testimony to this hearing.

As we in Rhode Island have been wrestling for the past 5 years with the problems and issues you have been addressing this morning, and which are addressed by the proposal in question.

We have been dealing with them rather unsuccessfully, and I hope to point out some of these reasons.

While we have made some progress, passage of this proposal in question today would cause a great leap forward, not only for the system applications for all of New England, but as a model for the rest of the country.

K through 12 schools, we have heard, institutions of higher education, and even American businesses to a lesser extent, have not kept pace with the emerging technology.

The Lincoln-Filene's Center for the Study of Mankind, right here in Boston, way back in 1967 found that schools are usually a human generation behind in the introduction of technology and advances into the curriculum. This is still true today for most of the advances in electronic communications.

Even beyond the tendency to avoid cooperation, schools and colleges have had little opportunity to work together in this arena.

Technological "haves" and "have nots" are found in education, and the "have nots" far outnumber the "haves." Even the "haves" do not approach the comprehensive nature of this proposal and what it might do for education, both K through 12 and higher education.

So often important course work is not offered on both levels because the individual school or school system has limited resources and such small numbers of students eligible for that particular experience.

With this proposal in question today, Russian language or advanced math, for examples, could be offered to students from several schools or several school districts.

The interactive nature of this proposed system, coupled with the two area resource centers, could reduce the problems of conventional tele-course offerings.

These present difficulties include passivity, the one-way communicative nature of the medium, and the arbitrary pacing of the material, among others. These would be greatly reduced by the interaction, the feedback loops, and the adjustments in the experiences prior to their completion that would be possible with this proposal.

From our Rhode Island experience, labor, both organized labor organizations who are members of our Council, and individual

members and workers in the labor force, could benefit from this proposal.

Generic programs on working conditions: workers' rights and responsibilities, et cetera, as well as instructional programs varying from high school equivalency instruction to specific job skills could be mounted and shared by all, both in the home, in the workplace, and in community centers.

The regional technical resource centers would be a boon to all of us. Presently, those of us working in this arena do so sporadically and work out of our back pockets.

We get caught up working directly with our clients, especially in continuing education, and find little time for rational discernment of what we are doing and how we can do it better.

Good ideas require development time and material resources most of us do not have. Inventive ideas without development die.

These regional centers would help considerably in both theory development and direct application of the technology to real problems.

In sum, we in Rhode Island would benefit from this proposal by being able, eventually, to tie in to the pilot system. Our Higher Education Council, as well as our considerable experience in linking up the entire State of Rhode Island, which we do at present by cable television, would be useful.

I am not here in power to speak for my whole State, but I feel confident I can pledge its support to this proposal, at least in these areas.

I see a real application of this educational communications proposal to all levels of schools for both direct instruction and for teacher in-service, well beyond the one-way experiences at present with either public television or tele-courses.

I see applications in the workplace for teaching entry-level skills to the underemployed, or updating skills of the "misemployed."

I see hundreds, perhaps thousands, of physically handicapped home or institution bound people being served humanely by this system.

Above all, this proposal, its wealth of interactive and responsive possibilities, would put the "people" back into the present impersonal electronic applications being used to date.

This is a critical element. This lack of opportunity for interaction between teacher and student, student and student, teachers and teachers, has impeded the development of this medium to date.

I and the Rhode Island Higher Education Cable Television Council, and the University of Rhode Island, since I have been authorized by the President of the University of Rhode Island, Dr. Ted Eddy, strongly support what it is you are trying to do here.

Thank you.

The CHAIRMAN. Thank you very much.

That is a helpful comment about reaching some of the workers to help to upgrade their skills. It is a point which, I think, is very significant, and one we had not focused on to a considerable extent earlier in the course of the hearing.

And the application for those in institutions or home bound would be of value and importance.

Tell me, Dr. Crocker, what percent of the students now have access to some cable television education programs?

Dr. CROCKER. The State of Rhode Island is unique in that it is small, and it is completely franchised—10 areas throughout the State.

There are presently hooked up—we are still stringing telephone wires and things like that—but 170,000 households out of a total of perhaps 390,000 households are presently hooked up and are customers. The difficulty with cable is one has to pay a monthly fee for even the basic opportunities. So, therefore, it will not go to all people in all areas of the State. It will not go to sparsely populated areas of the State because it is not economical for the cable companies to string the wires.

The CHAIRMAN. You were here earlier when—I asked the question about whether the kinds of profiles that we have been experiencing here in Massachusetts are being experienced in a similar way in Rhode Island, with the change of demography, additional pressures on school districts to maintain courses, and particularly in the areas of math and science, do you find this to be the case?

Dr. CROCKER. It is the same with us in Rhode Island, especially in the areas of math, science and foreign language, especially Russian, or something of that nature.

In addition, the continuing ed units of colleges and universities in Rhode Island try and work very closely with the schools.

In some cases, we welcome students on a release time basis; in other cases, we bend over backwards to do specialized tailored summer experiences. This is a band-aid attempt to plug a hole.

The CHAIRMAN. Okay. Well, we want to thank both of you very much for speaking to us about the support for this.

Dr. Knapp, we have not heard from you. I do not know if, just before making some closing comments, whether there is anything you would like to add.

We have your testimony before our Full Committee at your earlier presentation in Washington, which was very complete. You have been a real leader in all these areas.

If there is anything that you would like to comment on or add as we wind up our hearing here this morning, we would be glad to hear from you.

Dr. KNAPP. Thank you, Senator.

Let me simply add that what we have heard here today, I think, is the strongest confirmation one could have of the need for telecommunications, and particularly on a regional basis.

As somebody who has been looking at this for five or six years, I was absolutely delighted to listen to the testimony we heard, because it confirms what we had thought is indeed the case, particularly the need for linkage of the public schools, where I think we have a very serious problem. It is something we need to address and address as a region.

Thank you very much for the hearing.

The CHAIRMAN. Well, we want to, first of all, thank all of our witnesses here this morning for their taking the time to join with us, and for their presentation and participation.

I think we have had good helpful testimony.

We have heard from some of the students who are losing out because of the failure of the system, for a variety of different reasons, to be able to continue to provide the kinds of courses for them to be able to fulfill their own kinds of capabilities, and so that they will be able to be productive and useful citizens in a very involved and intricate international economy.

We heard about the difficulty that they have had in getting instruction. And we have heard about the challenge which continues to exist for teachers to continue to upgrade their skills, the extent to which they have gone to try to acquire those additional skills. And how the process and the system, for one reason or another, discourages that continued kind of drive for excellence and the opportunities that could be available and open to them with this kind of program.

We have heard about the effect of our system, as it is reflected in the various statistics, whether it is going to be the number of math and science teachers in force, or whether it is the other kinds of indications, which is the availability of mathematics instructions here versus some of our international competitors.

We are down toward the bottom, certainly, of any of the industrialized societies, and that is not being reversed or changed. If we look at the flow lines on this, it shows that we are in a continued period of deterioration.

We have heard reference to where we are in terms of the achievement scores on international tests. The figures over here (indicating chart) represent the United States in chemistry and physics. We probably can assume that it is going to be the more gifted students who are taking the courses at the current time are the ones that are going to take the international tests.

And we see on the international average where the United States is, and there is very little expectation that those figures are going to be reversed if we are going to do business as usual.

We do not expect that this program is going to answer all of those particular challenges. Clearly it will not. It is a multidimensional challenge for us as a society, and we understand that.

But we do believe that what we are recommending, or what has been recommended to us here today, can make some important differences to students and teachers, and to other groups in our society. And it can be done at an extremely reasonable financial commitment.

And I will leave this hearing and close it with the comment that I made at the opening of the hearing. And that is that we will introduce the legislation with a number of co-sponsors from States in New England and others the early part of next week, and we will hope to get a markup on this program in our Human Resources Committee in the next very few weeks, and hopefully get action on the Senate floor within the next very few months.

So we will leave this hearing and go about our business and do our work, and we know that, after we are able, hopefully, to get this enacted the bill will be right back in the court of the people here in New England.

Some of them have testified this morning—and there are many others all over our New England regional area. And we will look

forward to working with them as we hope to make this a part of the educational dream available to students across New England.

Thank you again for your courtesy and for your patience. And we will now recess the hearing.

[Whereupon, at 11:27 a.m., the committee adjourned, subject to the call of the Chair.]

"STAR SCHOOLS"—TELECOMMUNICATIONS IN EDUCATION

WEDNESDAY, MARCH 11, 1987

U.S. SENATE,
COMMITTEE ON LABOR AND HUMAN RESOURCES,
Washington, DC.

The committee met at 2:13 p.m., pursuant to notice, in room SD 430, Dirksen Senate Office Building, Senator Robert T. Stafford presiding.

Present: Senators Stafford (presiding), Kennedy (Chairman), Harkin, Pell, Thurmond, Cochran, and Humphrey.

Senator STAFFORD. The committee will please come to order.

The Chairman of the Committee will be here as soon as other commitments he has to finish thereby permit him to join us. In the meantime he has asked that we get started in the interest of time.

I have no opening statement and I am prepared to listen to the witnesses and I hope to learn. We will receive Senator Pell's opening statement for the record at this point.

OPENING STATEMENT OF SENATOR PELL

Senator PELL. Mr. Chairman, I would like to start at the outset by commending you for holding this hearing. You and I have worked long and hard over the years to ensure that adequate educational instruction was provided to every student regardless of economic or educational disadvantage or handicap.

In that regard, I am intrigued by the potential uses of telecommunications in carrying out this principle. While there is some concern that education by satellite breaks ground with traditional educational practice, I agree that we should not be bound by the constraints of current methods. Rather, I am of the mind that we should expand our vision to encompass the full range of instructional possibilities.

While we consider these ideas, however, I am hopeful that we will proceed cautiously. Our initial foray into technology in the classrooms began with the National Defense Education Act. This important act enabled school districts across the country to make use of the latest educational technology which at that time was television. Unfortunately, many of those televisions were assigned to basement storage rooms and unused because of the failure to provide adequate teacher training and curriculum development for this instrument.

As we move down this road, therefore, we must make every effort to ensure that teachers and officials at the participating

schools are fully involved. I apologize that I have to leave shortly for another engagement, but I shall carefully review the testimony of the witnesses here this morning.

I would also like to extend a special welcome to Alda Monteiro who is an outstanding student at East Providence Senior High School.

Senator STAFFORD. I see Senator Cochran is here.

Senator, do you have any opening statement?

Senator COCHRAN. Mr. Chairman, let me just say that I am looking forward to hearing the witnesses who will be testifying before the committee today. In our State, I want you to know that we are last in the number of areas, and that is continually repeated to us, but we are first in the construction of a statewide educational television network. It has been a very important contribution in the State of Mississippi in our effort to improve education and make it accessible to the students throughout the State.

I am glad that we are looking at that issue, how we can enhance our educational efforts through the use of telecommunications. I think it is an important area for us to look at and I hope we will learn from it.

Thank you very much, Mr. Chairman.

Senator STAFFORD. Thank you very much, Senator Cochran.

The first witness this afternoon will be Ms. Lauffer, who is the Program Officer for the International Education and Exchange Programs of the International Division for the Academy for Educational Development. She is also the former Director of Information for the Rural Satellite Program for the Agency for International Development, and former Senior Executive for Public and Media Relations for the International Telecommunications Satellite Organization.

We are very happy to welcome you here. I might say parenthetically that in the absence of the Chairman of the Committee, it is a pleasure for a former Chairman of the Education Subcommittee to temporarily find myself back in charge. [Laughter.]

So while we have this brief interlude, we will be very happy to hear from you.

STATEMENT OF SANDRA LAUFFER, PROGRAM OFFICER, INTERNATIONAL EDUCATION AND EXCHANGE PROGRAMS, INTERNATIONAL DIVISION, ACADEMY FOR EDUCATIONAL DEVELOPMENT

Ms. LAUFFER. Thank you, Senator Stafford and Senator Cochran. I would like to thank both of you and the other members of the Committee for giving me and other members of the panel today the opportunity to testify on the application of telecommunications technology to education.

This is a very exciting area, one which many individuals in the United States have been pursuing in various ways over the years, and one which certainly deserves concerted attention for its potential in serving American education.

My particular focus this afternoon is a discussion of some of the experiences of other countries in this area, in that there has been a lot of activity overseas that we could learn from.

Educators and policy makers generally have looked to telecommunications for help in attaining one of two goals: either to enhance the quality of instruction or to expand educational access. Some countries, of course, have turned to satellite technology to aid them in achieving these goals more often and I think more deliberately than the United States has.

The experience of many of these countries, including many to whom the U.S. gave the impetus with NASA's ATS satellites in the late 1960s and early 1970s supported by the U.S. Agency for International Development, could prove useful to us as we approach this topic.

I would like to begin with India, because India is one of the first countries to capitalize on the potential of satellite technology as a medium of mass communication and education. India first used satellites during the one year Satellite Instructional Television Experiment, which took place in 1975-76, using NASA's ATS-6 satellite. In that experiment, educational programs were broadcast to community television receivers in 2,400 remote villages in India. Program content focused on national integration, upgrading and expanding literacy, health, nutrition, population, and agricultural education.

Following on that experience and building on it, India inaugurated its own national satellite system, called INSAT, in 1983. The INSAT system has enabled India to expand its rural television network to reach nearly 60 percent of its rural population now. The system is used extensively for educational broadcasting, both at the primary school level and for teacher education.

In addition, India is developing a program to use INSAT to exchange educational programs between universities and as a medium for the national open university.

The second country I would like to look at is China. China has also availed itself of satellite technology to solve its education problems. It began using satellite capacity for education under INTELSAT's Project SHARE in August 1985, providing nationwide broadcasts of advanced academic courses for six hours a day.

In October 1985, China's Project SHARE network was expanded to 53 locations, and programming was also expanded at that time. The Chinese government recently purchased from INTELSAT a transponder to be used exclusively for educational broadcasting. That channel now broadcasts programming 18 hours a day, focusing particularly on the training of teachers.

One country very near to us that has been a leader in the development of satellite technology and its application to education is Canada. Canada was the first country to have its own commercial geostationary domestic satellite when it launched Anik A-1 in 1972. Later it launched the CTS Hermes experimental satellite jointly with the United States, which was designed to offer two years of in-orbit capacity for experimental education, health, and other community service applications. Hermes actually lasted nearly four years, and the experiments that were carried out using Hermes were important in paving the way for the operational Anik B satellite launched in 1978. Anik B also had an applications program that focused particularly on education and health.

Several strong operational programs have grown out of these early government-supported efforts. By 1986, all four provincial educational communications authorities were distributing educational programming by satellite in Canada. For example, TV Ontario has a broadcast network which reaches about 95 percent of its province's population. It broadcasts 16 hours a day, providing programming for pre-school children and youth at home, university and college students, and adults. TV Ontario also delivers programming assistance to the Native Eskimo community in Cree, Ojibway, and Oji-Cree languages to the northern Ontario rural communities.

In the Asia-Pacfic area, Australia and Japan are both examples of countries that have well-established distance education systems that are gradually beginning to take advantage of satellite transmission capability as it becomes available domestically. AUSSAT's domestic satellite was launched in late 1985 and is gradually building up its capacity in educational programming.

The government of Queensland, for example, has established a statewide satellite communications network providing educational medical services using AUSSAT.

In Japan, educational television, which has a very long and distinguished history, has primarily been distributed by terrestrial means, rather than through the use of satellites. I think it is worth noting that Japan has a separate network for educational television programming and has one of the largest budgets for public broadcasting in the world, more than twice that of our own PBS. It spends some 37 percent of that budget on educational broadcasting.

Interestingly, also in Japan, their educational television has flourished at the primary school level, but not at the secondary level.

Before closing, I would like to focus just for a moment on some non-television broadcast technologies because there are a number of countries that have benefited from systems that use audio conferencing, either alone or in support of broadcast programming.

I think one institution that deserves particular mention for its persistence in the use of technology is the University of the South Pacific, which began using one of the experimental NASA satellites in 1972 for audio teleconferencing among its eleven extension campuses and used that satellite until the satellite was turned off in August 1985. That service was so critical to the extension system in the university that it has been looking ever since for an operational capacity that it can use to continue the service.

Similarly, distance education programs in Indonesia and the Caribbean have been carried out using audio teleconferencing systems. Indonesia was the first developing nation to inaugurate its own domestic satellite system in 1976 and now uses the Palapa satellite to link 13 of its universities across the islands. This distance education project is used primarily for educational delivery to university students and to upgrade the skills of university teachers

Similarly, in the West Indies, the University of the West Indies uses an audio conferencing system to link six islands for higher education and in-service training. The——

Senator STAFFORD. I see you are getting near the end. Let me tell you that all of your statement will appear in the record as if read.

Ms. LAUFFER. Certainly.

Senator STAFFORD. If you could conclude now in the next minute or so, we would appreciate it.

Ms. LAUFFER. I would be pleased to.

I think it should be noted that both of the projects I just mentioned were funded by the U.S. Agency for International Development.

The two conclusions I would draw from the projects that I have enumerated are the importance of funding for program software and the importance of building in a two way communications capability for those systems.

Thank you very much, Senator Stafford.

[The prepared statement of Ms. Lauffer follows:]

INTERNATIONAL EXPERIENCE IN THE USE OF SATELLITE COMMUNICATIONS FOR EDUCATION

Prepared for the Committee on Labor and Human Resources
United States Senate
Hearings on Telecommunications and Education
March 11, 1987
by

Sandra Lauffer
International Division
Academy for Educational Development

Educators and education policy makers generally look to telecommunications for help in attaining one of two goals: either to enhance the quality of instruction or to expand educational access. The educational communities in countries other than the United States share these goals. Some countries, however, have turned to satellite technology to aid them in achieving their educational goals more often -- and more deliberately -- than has the United States. The United States now has an opportunity to take a second look at the educational potential of communications satellites. The experience of other countries, including many to whom the U.S. gave the impetus with NASA's experimental ATS satellites in the late 1960s and early 1970s, supported by the U.S. Agency for International Development, may prove useful as we examine the technology's potential for improving educational quality and access.

India was one of the first countries to capitalize on the potential of satellite technology as a medium of mass communication and education. India first used communication satellites during the one-year Satellite Instructional Television Experiment (SITE), which took place beginning in August 1975 using NASA's Applications Technology Satellite, ATS-6. In that experiment, educational programs were broadcast to community television receivers in 2,400 remote villages. Program content focused on national integration and on upgrading and expanding literacy, health, nutrition, population, and agricultural education.

Following on that experience, India built and launched an experimental telecommunications satellite in 1981, and inaugurated its operational national satellite system, INSAT, in 1983. The INSAT system has enabled India to expand its rural television network to reach nearly 60 percent of the nation's population. The system is used extensively for educational programming. INSAT has two direct broadcast television channels which transmit programs to 3,000 specially adapted television sets in rural villages.[1] At the primary school level,

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[1] V. Kopal, "Communication Satellites for Development," in Telecommunications for Development: Exploring New Strategies. Proceedings of a conference held in New York on October 18, 1986. (Washington, D.C.: INTELSAT, 1986)

educational programming is broadcast five days a week for about 45 minutes each day, with one program each for the age groups of 5-8 years and 9-11 years. Programs for teachers are broadcast on Saturdays. The Indian Ministry of Education has sponsored the development of State Institutes of Educational Technology in the six INSAT TV states, which are taking over the responsibility for ETV program production. In addition, India's University Grants Commission is developing a program to use INSAT to exchange educational programs between universities, and as one medium for the national open university.

China has also availed itself of satellite technology to solve its education problems, primarily for higher education, as distance education is little used in China for primary and secondary education.[2] China began using satellite capacity for education under INTELSAT's Project SHARE in August 1985, providing nationwide broadcasts of advanced academic courses for six hours daily to a network of 20 earth stations. (Project SHARE is a program to provide free satellite access for experiments in delivering health and education services to rural areas of developing countries.) Programs for transmission are prepared by the China Central Radio and TV University, which has been offering courses by terrestrial means since 1979, in subjects such as mechanics, electronics, mathematics, physics, and chemistry. Not surprisingly, China has the largest distance education system in the world. Its system of Radio and Television Universities have an enrollment almost equal to that of regular institutions of higher learining, with some 1.4 million students enrolled in degree programs in 1985.

In October 1985, China's Project SHARE network was expanded to 53 locations, and programming was expanded to include more diverse materials, including non-academic subjects such as lectures on calligraphy and the oriental fine arts. The Chinese government has subsequently purchased two transponders from INTELSAT, one for educational broadcasting and one for news and cultural programming. The first went into service in July 1986, and the second in January 1987. The educational satellite channel broadcasts programming 18 hours a day. The network of 53 television receive-only earth stations was donated by the Chinese government and distributed in every province, and the number of TVRO earth stations is expected to grow rapidly. Meanwhile, program tapes are distributed by conventional means throughout the states and districts in each province.

China's pursuit of satellite communications for education has focused particularly on the training of teachers. There are some 340,000 teachers at the university level, three million at the secondary level, and 5.3 million at the primary level. A 1983 government report estimated that 48 percent of the elementary schoolteachers were underqualified, and other reports indicate that

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[2] Peter J. Seybolt, "Education," in China Briefing, 1985, edited by John S. Major. (Boulder, Co.: Westview Press, 1985).

the proportion could be as high as two-thirds.[3] Thus, satellite technology could make a substantial contribution to national educational development in China.

One country that has been a leader in the development of satellite technology, and that has steadfastly pursued its application to the education sector, is Canada. With 80 percent of its population centered along its southern border, the country has vast reaches in the north where population centers are small and distant from one another. Telecommunications has therefore played an important role in bringing social services to the isolated population in the more remote areas of the country.

Canada became the first country to have its own commercial geostationary domestic satellite when Anik A-1 (a 6/4 GHz satellite) was launched in November 1972. It pioneered the use of higher powered satellites in the 14/12 GHz range with the experimental Hermes satellite, launched jointly with the United States in 1976. Hermes was designed to offer two years of in-orbit capacity for experiments in education, health, and other community service applications, using relatively small earth stations. Hermes lasted nearly four years, and its experiments were important in paving the way for the operational Anik B, launched in 1978. Canada thus also became the first country to offer commercial telecommunications in the 14/12 GHz band. Anik B also had an applications program designed to give educators and other experimenters an opportunity to test the viability of proposed operational programs.

Several strong operational programs grew out of these early government-supported efforts. By 1986 all four provincial educational communications authorities -- TV Ontario, Radio-Quebec, the Knowledge Network of the West, and the Access Network -- were distributing educational programming by satellite. The Knowledge Network, for example, relays programs for direct reception by students in their homes in the more remote areas of the country, as well as for cable distribution in more urban areas.

TV Ontario serves a province of one million square kilometers, and a population of nine million, many in widely scattered communities. The TV Ontario broadcast network reaches about 95 percent of the province's population. It broadcasts 16 hours a day, except during July and August, providing programming for pre-school children, children and youth at school and at home, university and college courses, and adults, in subjects such as public affairs, arts, social issues, and science. TV Ontario also distributes televised proceedings of the provincial legislature, as the C-Span network does in the United States.[4]

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[3] Ibid.

[4] Bernard Ostry, "Satellites for Learning," Intermedia, July/September 1986, pp. 69-72.

The Hermes and Anik pilot projects also supported Inuit (Eskimo) communications needs, and the operational programs have continued to support native communities. For example, TV Ontario provides a Native Radio Service on an audio sub-carrier. In January 1987 it began providing assistance to the Wawatay Native Communications Society in distributing native television programming via satellites to 27 communities in remote northern Ontario. The programming, in Cree, Ojibway, and Oji-Cree languages, features community profiles, activities of children and young adults, segments on band leaders, native-language teaching, community events, and local news.

Canada's Department of Communications recently commissioned a two-part study on distance education, related to an extensive effort now underway among the Commonwealth countries to establish an international center for distance education. The first part of the study assessed the range of technologies that can be used for distance education and that have potential for application in Commonwealth distance learning initiatives. The second part is exploring the economics of various distance learning options and course production requirements. The final studies are expected by early April and will be tied into the final report of the Commonwealth Expert Group on Distance Learning.

Australia and Japan are two examples of countries that have well-established distance education systems that are gradually taking advantage of satellite transmission facilities as these become available domestically. Australia's vast area and relatively small, dispersed population have made it a logical candidate for distance education. The same characteristics led it to develop a domestic communications satellite system, AUSSAT, which became operational in late 1985.

In Western Australia, children who live beyond the range of school bus services study at home through the primary grades, and even into secondary school.[5] They are served by the Distance Education Centre in Perth, and by the School of the Air (SOTA) system, which administers correspondence lessons and broadcasts supplementary material for 30 minutes each day to each school grade.[6] Several years ago the Australian Broadcasting Corporation (ABC) began using an INTELSAT Pacific Ocean satellite to extend the reach of its network, which includes schools broadcasts, into remote areas that had been beyond the range of terrestrial television reception. Now, with the AUSSAT domestic satellite system, Australia is beginning to expand its use of satellites for education. The Government of Queensland has established an operational

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[5] UNESCO, Distance Education in Asia and the Pacific (Bangkok: Unesco Regional Office for Education in Asia and the Pacific, December 1985)

[6] Peter Hosie and Tony Dean, "TV for Isolated Students in Western Australia," Media in Education and Development, September 1984, pp. 140-145.

statewide satellite communications network to provide education and medical services. One experimental School of the Air service based in a remote mining community links ten homesteads with two-way voice and data communications to the SOTA center. A broadcast video signal from Brisbane is also part of the education service.[7] In another recently initiated service, the Golden West Network in Western Australia, the first commercial station to undertake a Remote Commercial Television Service under AUSSAT, offers two hours of educational programming each day -- one program for aborigines, and one program by and for primary schoolchildren.

In Japan, educational television has a long and distinguished history, although it has primarily been transmitted by terrestrial means. In 1959 the Japanese Broadcasting Corporation (NHK) established a separate network for educational television programming. By 1985 the network was broadcasting 18 hours a day, covering nearly every school subject at nearly every grade level, including adult education in the evening hours.[8] NHK has one of the largest budgets for public broadcasting in the world -- more than twice that of the Public Broadcasting Service -- and spends some 37 percent on educational broadcasts.

Interestingly, educational television has flourished in Japan's primary schools, but not in secondary schools, for a number of reasons which seem to be related to the intense emphasis in secondary schools on preparing for college entrance exams, and the traditional ways of pursuing that goal. Secondary schools are highly teacher-centered, with classes built around straight lecture methods, and teachers have had little desire for educational innovation. Japan's new University of the Air, dedicated to facilitating lifelong learning through the use of television and radio broadcasting, may be one of the first Japanese educational institutions to truly capitalize on the potential of satellite communications for education.

The examples of satellite-delivered educational services discussed thus far have focused on educational television. It would be a tremendous disservice to educators and policy makers throughout the world to leave the impression that television is the only, or even the most important, educational medium that satellites are capable of transmitting. On the contrary, a great deal of benefit has been gained by students and teachers in many countries from the two-way communications made possible by audioconferencing and other non-broadcast technologies, either alone or in combination with broadcast programming.

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[7] Michael Wagg, "Aussat -- Satellite Services in Australia," in PTC '87 (Honolulu, Hawaii: Pacific Telecommunications Council, 1987)

[8] Drew Tiene, "Japanese Educational Television: An Intriguing Case Study," Media in Education and Development, September 1985, pp. 133-137)

One institution that deserves special mention for its persistence in the use of satellite technology, sometimes against incredible odds, is the University of the South Pacific (USP). In 1972 USP began to use NASA's ATS-1 satellite for its extension studies program, conducting satellite tutorials and other distance education programs for its extension students, distributed throughout the 11 countries the University serves, spread over some 11 million square miles of ocean. USP established a narrowband audio teleconferencing system and eventually added microcomputers and slow-scan video to supplement the system. Unfortunately, after providing 14 years of service to the Pacific Basin, the ATS-1 satellite was deactivated in August 1985, and USP has been urgently trying to find long-term satellite capacity to replace the service. In the meanwhile, it has been able to take advantage of INTELSAT's Project SHARE to maintain teleconferencing services between those campuses on islands with INTELSAT earth stations.

Distance education programs in Indonesia and the Caribbean have also been developed using audio teleconferencing systems, modeled to some extent on the earlier USP experience. Indonesia, the first developing nation to inaugurate its own domestic satellite service with the launch of Palapa A in 1976, now uses its satellite system to link 13 universities spread across the islands. Responding to persistent problems of faculty shortages and inadequately trained faculty, the distance education project was designed to provide quality education to university students and to upgrade the skills of university teachers, as well as to support research and administrative activities. Over 15 courses are taught over the system each semester, reaching thousands of university students who would not otherwise have access to the courses.

Similarly, in the West Indies, university campuses on six islands are linked by a hybrid satellite-microwave system. Using the system, the University of the West Indies trained over 500 doctors and nurses in 1985. It has also been able to double the number of teaching certificates awarded annually because of the expanded training opportunities made available by the system.[9] Like the USP network, the projects in Indonesia and the Caribbean were both developed with support from the U.S. Agency for International Development.

Several important conclusions have emerged from this range of experience in other countries that bear consideration as we explore educational satellite applications in a structured way in this country. One is the need to focus on the production of software, and the need to commit adequate funding to this process. One expert in the field, Allan Hershfield of the International University Consortium for Telecommunications in Learning, has stated that "There are...some

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[9] Douglas Goldschmidt, Karen Tietjan, and Willard D. Shaw, Design and Installation of Rural Telecommunications Networks: Lessons from Three Projects (Washington, D.C.: Academy for Educational Development, January 1987)

major industrial nations, such as the U.S. and Canada, where government and educational leaders talk a great deal about the telecommunications revolution and its impact on education, but do not understand the need to commit funds to software development. They have focused exclusively on telecommunications hardware."[10] One source suggests a general guideline that "no more than 30 percent of all annual expenditures should be devoted to the capitalization of a satellite and terrestrial communications system, leaving 70 percent for the maintenance, development, and operation of programming and other human resource aspects of the project, such as field workers and teachers."[11]

A second important conclusion is the need to build into any educational telecommunications network a two-way communications capability, whether as the central element in the system or in conjunction with broadcast programming, so that students and teachers, no matter how remote from a central location, can interact with each other and get the kind of immediate feedback that plays such an essential role in the educational process. This two-way communications process can be much more easily achieved in the United States than in many other countries, thanks to the nearly universal coverage of the national telephone system.

This brief review of the past decade's experience in using communications satellites to expand the reach and the quality of education can only serve to illustrate that, practically from the technology's earliest days, its potential was recognized, and it has been tested and proven in a variety of settings, at many educational levels, and using a range of technologies. We can call on this body of experience in bringing quality education to underserved populations in the United States as well.

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[10] Allan Hershfield, "The Role of Telecommunications in Education: An Introduction," Informatologia Yugoslavica 17 (1-2), pp. 89-95 (1985)

[11] Joseph N. Pelton and Robert T. Filep, "Tele-Education via Satellite," in Toward International Tele-Education, edited by Wilbur T. Blume and Paul Schneller (Boulder, Co.: Westview Press, 1984)

Senator STAFFORD. Thank you very much for a very good statement. I always feel apologetic to ask people after all the work they have done, to try to say it all in five minutes. We know the difficulties that we cause and we apologize for that.

I see that Senator Thurmond has joined us. Senator, do you have an opening statement or any comments that you wish to make?

Senator THURMOND. Thank you very much.

Mr. Chairman, I am in an Armed Services Committee meeting and must go back there as quickly as possible, but I wanted to take this opportunity to introduce a gentleman to the committee who will testify.

The educational community faces a number of challenges in the coming years. We live in a rapidly changing world, where the work force not only must be highly skilled, but constantly learning new skills to keep up with new technologies. Many studies indicate that soon America may face a shortage of teachers skilled in the math, science, and computer fields. The use of telecommunications in education can help solve these problems in a cost-efficient, relatively inexpensive way.

Mr. Chairman, today we will hear testimony from Henry Cauthen, President of the South Carolina Educational Television Network. I would like to take this opportunity to welcome Henry and to introduce him to the rest of the committee. Henry Cauthen has been President of the SCETV Network since 1965. Under Henry's leadership, SCETV is now recognized nationally as one of the leaders in educational telecommunications.

Henry also has served as a board member on many public and private organizations. He has previously served as a member of the National Council of the Arts, and is currently serving as a member on the boards of such organizations as the Carnegie Commission on the Future of Public Broadcasting, the Indo-U.S. Subcommittee on Education and Culture created by then Secretary of State Kissinger, the National Council for Children and Television, and the National Association of Public Television Stations.

Furthermore, as a member of the Instructural Television Advisory Committee to the Public Broadcasting Service, and as former Vice Chairman to the PBS Board of Directors, Henry is well qualified to speak about educational telecommunications.

Mr. Chairman, under the leadership of Henry Cauthen, SCETV has blazed the trail in innovations in the telecommunications field. For instance, South Carolina has developed a teleconference system which last year conducted over 600 training conferences and instructional services which were distributed through its network facilities. SCETV used its sophisticated satellite resources to serve an estimated teleconference audience of 20,000.

Mr. Chairman, you may be interested to know that a recent conference consisted of a satellite hookup between SCETV, Harvard University and the Soviet Union, to discuss implications of the Soviet nuclear disaster before an international audience of scientific and government leaders. The SCETV teleconference network is well developed in our educational community. It reaches 16 technical colleges and 10 university regional campuses.

Mr. Chairman, SCETV has also developed literally hundreds of instructional programs for all levels of education. For instance, I

know they are proud of the role they played in developing a new instructional program entitled "Math Works." "Math Works" consists of 28 15-minute programs to help fifth graders learn mathematical skills and problem solving strategies. Programs such as these reach over 93 percent of our public schools in South Carolina.

Henry, we are glad to have you here today and I am confident that this Committee will benefit by the valuable insights you have to offer in this area.

Mr. Chairman, I thank you very much for allowing me to go ahead at this time.

Senator STAFFORD. Thank you very much, Senator.

Ms. Lauffer, I have a few questions here if you——

Senator THURMOND. Mr. Chairman, since I will have to be leaving, I have a few questions here, eight questions I was going to propound to Mr. Cauthen. Would you mind propounding them for me? I would appreciate it.

Senator STAFFORD. I would be glad to. I would say both to Ms. Lauffer and to President Cauthen that if they find the questions agreeable, I will try to take credit for them. If they do not, they can blame either Ted Kennedy or Strom Thurmond.

Senator THURMOND. Ms. Lauffer, we are glad to have you with us, too, and these other witnesses. I am sorry that I have to leave.

Ms. LAUFFER. Thank you, Senator Thurmond.

Senator THURMOND. Ms. Lauffer, the use of telecommunications for educational purposes by other countries is remarkably extensive. Many less-developed nations which we would not have thought to be ahead of the United States in the use of this technology in fact are. Can you tell us how this came to pass. Are other countries so technologically advanced or are we simply way behind?

Ms. LAUFFER. Senator Stafford, I think one of the important points to make on that is that many of these countries got their start in educational telecommunications thanks to the United States in the early Applications Technology Satellite experiments, when NASA made satellite capacity available to them free to test potential applications. That got them moving and got them to the point where they could then take off on their own on their operational systems.

The U.S. has also carried out some on-going programs from that early experience. They have not perhaps had the visibility that they deserve. I would call particular attention to the State of Alaska's telecommunications system, Learn Alaska, and to The Learning Channel, based here in Washington.

Senator STAFFORD. Thank you very much. Can you tell us how the use of telecommunications is regarded in the countries where you have studied it? Is it considered a successful, positive supplement to traditional education?

Ms. LAUFFER. I think one of the best answers to that would be referring again to the University of the South Pacific which sometimes seems to be on the point of desperation when they consider that they do not have on-going satellite capacity to carry that forward.

Senator STAFFORD. How do the ways in which this technology has been used abroad compare with the ways we are looking towards

student education at the elementary, secondary and post-secondary levels, higher education, continuing and adult education and basic skills, as well as highly technical advanced degree programs, teacher training, health centers, and so on?

Ms. LAUFFER. I think all of those areas have been explored in one or another of the projects that I have cited today. They really do run the range and I think are very, very comparable to our experience and our aspirations.

Senator STAFFORD. Thank you very much, Ms. Lauffer. For the full Committee and myself, we are much appreciative of your help.

Ms. LAUFFER. Thank you very much.

Senator STAFFORD. The next witnesses will be a panel on domestic use and potential, consisting of Dr. Joseph Duffey, who is the Chancellor of the University of Massachusetts at Amherst, and former Director, National Endowment for the Humanities; President Henry Cauthen, of South Carolina Educational Television Network; and Will Kitchen, Vice President, Tele-Systems Associates, Inc., of Minneapolis, Minnesota.

We welcome you all here. The Chair would hear you I think in the order in which I called your names, if that is agreeable. And I would say to Dr. Duffey, do not be misled by that picture on the chart of southern Vermont I see over there on the board.

STATEMENT OF JOSEPH DUFFEY, CHANCELLOR, UNIVERSITY OF MASSACHUSETTS AT AMHERST; HENRY CAUTHEN, PRESIDENT AND GENERAL MANAGER, SOUTH CAROLINA EDUCATIONAL TELEVISION NETWORK; AND WILL KITCHEN, VICE PRESIDENT, TELE-SYSTEMS ASSOCIATES, INC.

Mr. DUFFEY. Thank you, Senator Stafford. I want to thank you and the members of this Committee for this hearing and the opportunity for those of us who have a vital interest in the future of education and its relation to the future of our regions and the Nation to testify.

I would be remiss, Senator Stafford, if I did not pause for just a moment, on behalf of at least one institution of 25,000 students and their parents, to express our appreciation for the strong support of this Committee for student aid and for the Committee's vision of the future of higher education. This committee, on both sides of the aisle, has given a great encouragement to families and students and we are grateful for your support.

Senator STAFFORD. Thank you, sir. We appreciate that.

Mr. DUFFEY. I think it is remarkable that in the last few weeks part of the attention of the Nation has begun to shift a bit perhaps from Star Wars to what is being called Star Schools, and I want to talk a bit about the concept of telecommunications and education.

I am chastened just a bit to be in the presence of Henry Cauthen, who has been my mentor in this area. I had a little opportunity, during my service in the Federal Government to provide some support for the magnificent network that exists there and, as Senator Cochran said, in Mississippi and also in South Carolina. The networks were developed to explore the uses of this technology for education.

In New England, Senator Stafford, I guess we are all aware that we do not have a great many natural resources. Our people, their minds and their potential are our resources. We do not produce steel, we do not have great agricultural subsidies. We now talk about high-tech as our leading resource. The future of our citizens and their ability to participate in the economy is critical to a vital and strong economy and society.

I noticed that after an interview with Senator Kennedy last week, George Will wrote in Newsweek about using what he calls "the technological means of magnifying resources." We are really talking here about doing more with what we have: taking modern technology and applying it, and making the best of resources in a rather critical time.

Although this is essentially a human endeavor, I am going to speak very briefly about the new potentials of communications technology. And I want to talk about what I think a rather unique human organization that has come together in Massachusetts over the course of the last few years and some of our plans and visions both for our State and for the region.

Essentially, the Massachusetts Corporation for Educational Telecommunications is trying to address the problem of the future of an economy in which there will be no surplus workers or citizens, in which we will need every citizen available to participate to the maximum of their potential in the economy.

The National Association of Black Colleges has a motto: "the mind is a terrible thing to waste." But I think as far as the future of our Nation is concerned, the mind is also a very costly thing to waste. We are going to need every citizen trained to his or her maximum potential in order to have a strong and competitive economy—and that means those who may not live in urban or privileged areas, but who are nevertheless vital and will have to participate in our economy in an important way.

All our technology and all the best intentions will really be to no avail unless we can have—in our economy and in our society—the kind of cooperation we need to be competitive as a society. And what the new communications, technology which is ahead of now provides us is an opportunity to test and learn how to cooperate better.

The Massachusetts Corporation for Educational Telecommunications has, within the past three years brought together a wide array of institutions. I would like to submit for the record, along with my prepared remarks, Mr. Chairman, a list of the institutions and letters of endorsement that participate in this endeavor. They go all the way from our great independent universities, Massachusetts Institute of Technology and Harvard, to our community colleges, our public universities, our health centers, along with many of our corporations and government agencies.

Together we are anticipating the next stage of educational telecommunications. Let me say just a word about how this network would look, not only in Massachusetts but I think in other parts of the New England region. I talk about my State and our region simply to use it as a model. Henry Cauthen can talk about what already has been done in South Carolina and how that system has

indeed, as Senator Thurmond said a moment ago, functioned to provide an international opportunity for that State.

With the kind of technology that is available now, it would be possible for us to carry out very intense two-way communication and teaching, using the kind of dish we see here, at any high school or institution, to receive satellite communication—which is dramatized here in a model of a satellite, which I guess is really about 40 feet long.

In New England, our plan now, under the Corporation for Educational Telecommunications, is to link our States with a microwave network, and then to provide in two parts of the State, at Boston University and the University of Massachusetts at Amherst, which are partners in this venture, satellite transmitters, or up-links, so that programming from other institutions can then become available through the satellite to institutions all over the region.

Let me say a word about the potential of this. The small school teaching business or management education which now realizes that it is critical to be able to teach the languages of the Pacific Basin can use the facilities of language instruction at Middlebury College, for example, (which are really some of the best of the Nation), or at the University of Massachusetts at Amherst or at Harvard to make these courses available everywhere.

A corporation such as Prime Computer or Wang Computer, which has an outstanding scientist or a businessman, can make him available three afternoons a week to teach the kind of course that our high school students in a rural area would never have otherwise.

New high-resolution technology makes it possible for doctors to consult even to the intricate analysis of a slide because of the quality of the new television, so that an illness can be diagnosed and doctors can consult across the region on very technical matters—in terms of diagnosis which sometimes can be the difference between life and death and certainly will preserve the precious time of medical personnel.

The opportunities are regional, as I have said, because this is a whole New England network. I guess we have one more map overlay here. As you know, Senator Stafford, we are still trying to figure out the high technology of dairies and farms in Massachusetts, and we borrow much of that technology from Vermont, the University of Vermont and other facilities there. The opportunity to consult and to share those resources, the resources of knowledge which are really vital to our region, we consider to be very important.

With this as background, let me say just a few more words about the importance of telecommunications to an educator. We find and I have talked recently with President Lattie Coor, of the University of Vermont, and I know he has the same experience that many of the students who come to us have an unequal opportunity to go as far as they might. If the student has an outstanding aptitude for mathematics—and that seems to be rather randomly scattered across the population, it doesn't always occur in the most privileged areas or the urban areas—the opportunity for developing that student's potential depends more on whether he or she comes from a school that offers the opportunity to study.

We find that our students come, oftentimes, with differing abilities to compete because of the quality and really the opportunities that they have found in their high schools: whether they have lived in a rural area, or in an area (as is true in our section of the country) where enrollments are declining and schools are no longer able to offer courses in particular subjects.

For that reason, I am interested in the possibilities this technology can provide, and I believe they are so much more significant now than they were a few years ago because of the sophistication of the technology (being able to address in a targeted way from a satellite to a specific institution), and the new opportunity it provides for sharing courses among public schools and parochial and private schools.

I must stress again, it is the cooperation, the human network, the human endeavor that makes it possible, and that is what we hope to demonstrate in Massachusetts.

We can share scarce teaching resources via telecommunications and particularly that is important in a time when we simply will not have the math and science teachers that we need for the next decade. We can overcome many of the factors—dwindling enrollments, scarcity of qualified teachers, lack of funding—that contribute to the persistent educational gap between "have" and "have not" communities. And we can provide teachers with ready access to professional continuing education.

At the University of Massachusetts at Amherst, we know this works with professional education. Through satellite communication today, we provide courses in very sophisticated fields to laboratories and industries on-site in more than 500 locations across the Nation, and give students and teachers access to resources and materials that they do not have available now.

The benefits for primary and secondary school teachers are the ability to provide advanced science, math and foreign language courses that we cannot afford to make available in individual schools. Many of our high schools, as I have said, are being forced to drop courses in specialized subjects due to declining enrollments and the shortage of qualified teachers.

For teachers, this network can enable them to continue their training and keep up with rapid changes in fields such as science and computer education. For college faculty and students, even at the largest research universities, the network can provide currently unavailable access to information at other institutions.

We can be more efficient with the help of telecommunications. Engineers can receive the first two years of their education in community colleges, through the use of satellite and telecommunications links, and then finish their work at the university. Or we can collaborate with colleagues hundreds of miles away on very sophisticated research.

For the industrial work force, telecommunications can provide continuing education courses in advanced engineering, computer sciences, and business subjects that are urgently needed if the region and the country are to compete successfully.

For health care workers, the network can provide shared continuing medical education and consultation opportunities that now are simply not possible.

We believe that all sectors—public and private, primary and secondary schools, higher education, industry and health care—can be served through this network.

The most important concept, I think, that is emerging in education these days is what Professor Hodgkins calls "the sense that it really is all one system," that we must view our educational resources in a comprehensive sense, and the challenge and opportunity of technology at this current stage of advancement is the opportunity to do just that. It provides the opportunity to create a level of cooperation in our States and across the Nation between these institutions that is vital if we are to make the most of the resources and be a Nation as strong and competitive as we hope to be—and I believe must be—in the future.

Senator Kennedy, I began by quoting George Will. I think you may be responsible for the fact that he is starting to talk now about Star Schools. I end by saying that it's an extremely encouraging development to all of us to see this Committee's leadership and interest in helping us to make maximum use of our resources so that we can protect the future of the Nation.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Duffey and his responses to questions submitted by Senator Pell follow:]

TESTIMONY OF

JOSEPH DUFFEY

CHANCELLOR, UNIVERSITY OF MASSACHUSETTS

AT A HEARING CONDUCTED BY

U.S. SENATOR EDWARD M. KENNEDY

CHAIRMAN, COMMITTEE ON LABOR AND HUMAN RESOURCES

WEDNESDAY, MARCH 11, 1987

2:00 P.M.

SENATE OFFICE BUILDING

WASHINGTON, DC

MY NAME IS JOSEPH DUFFEY AND I AM THE CHANCELLOR OF THE UNIVERSITY OF MASSACHUSETTS AT AMHERST.

SENATOR KENNEDY, I WOULD LIKE TO THANK YOU FOR CONDUCTING THIS HEARING ON THE DEVELOPMENT OF A REGIONAL EDUCATIONAL TELECOMMUNICATIONS SYSTEM AND FOR PROVIDING ME AND OTHERS WHO SHARE A VITAL INTEREST IN THE FUTURE OF OUR REGION AND OUR NATION WITH THE OPPORTUNITY TO TESTIFY.

FIRST OF ALL, I WANT TO EXPRESS MY APPRECIATION TO YOU, MR. CHAIRMAN, FOR YOUR LONG AND ABIDING INTEREST IN EDUCATION. IN THE COMMONWEALTH OF MASSACHUSETTS, WE VALUE EDUCATION AND KNOWLEDGE BECAUSE OUR PEOPLE ARE OUR ONLY NATURAL RESOURCE. OUR ECONOMIC STRENGTH DEPENDS UPON THE QUALITY OF OUR EDUCATION. I WANT TO SPEAK BRIEFLY ABOUT THE USE OF NEW TECHNOLOGY TO ENHANCE AND STRENGHTEN OUR PROGRAMS OF EDUCATION.

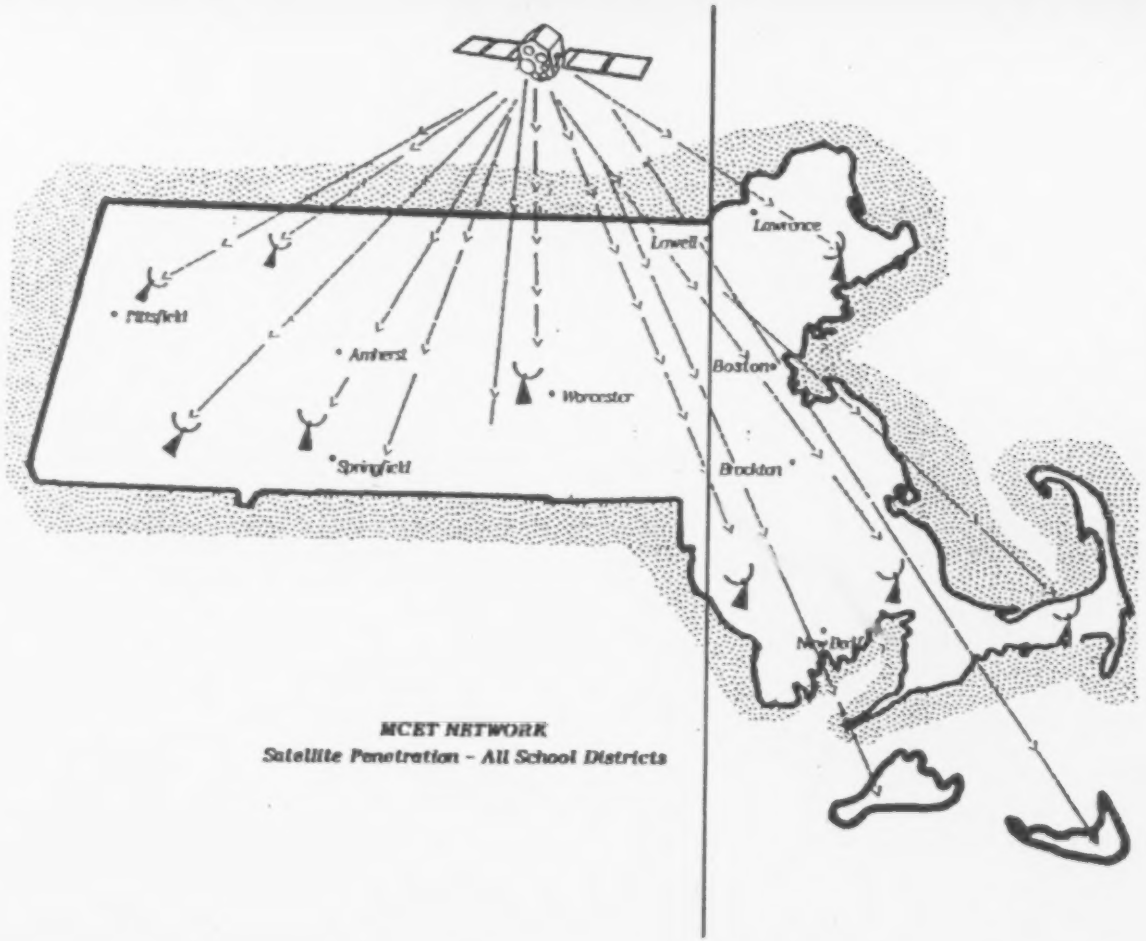
SOME OF THE MOST INTERESTING AND COMPELLING COMMENTS ABOUT EDUCATION THESE DAYS ARE NOT COMING FROM THE DEPARTMENT OF EDUCATION, BUT FROM THE SECRETARY OF LABOR. MR. BROCK HAS SPOKEN QUITE FORCEFULLY ABOUT THE FACT THAT IN THE VERY NEAR FUTURE WE WILL NOT HAVE SURPLUS POPULATION IN THE UNITED STATES. IN FACT, WE WILL FACE A SHORTAGE OF COMPETENT, EDUCATED WORKERS IN A NUMBER OF FIELDS.

THE MOTTO OF THE NATIONAL ASSOCIATION OF BLACK COLLEGES IS "THE MIND IS A TERRIBLE THING TO WASTE." WE CAN SAY, AS FAR AS THE FUTURE OF OUR NATION IS CONCERNED, THAT THE MIND IS ALSO A VERY COSTLY THING TO WASTE. WE ARE GOING TO NEED EVERY AMERICAN TRAINED TO THE MAXIMUM POTENTIAL IN ORDER TO HAVE A STRONG AND COMPETITIVE ECONOMY.

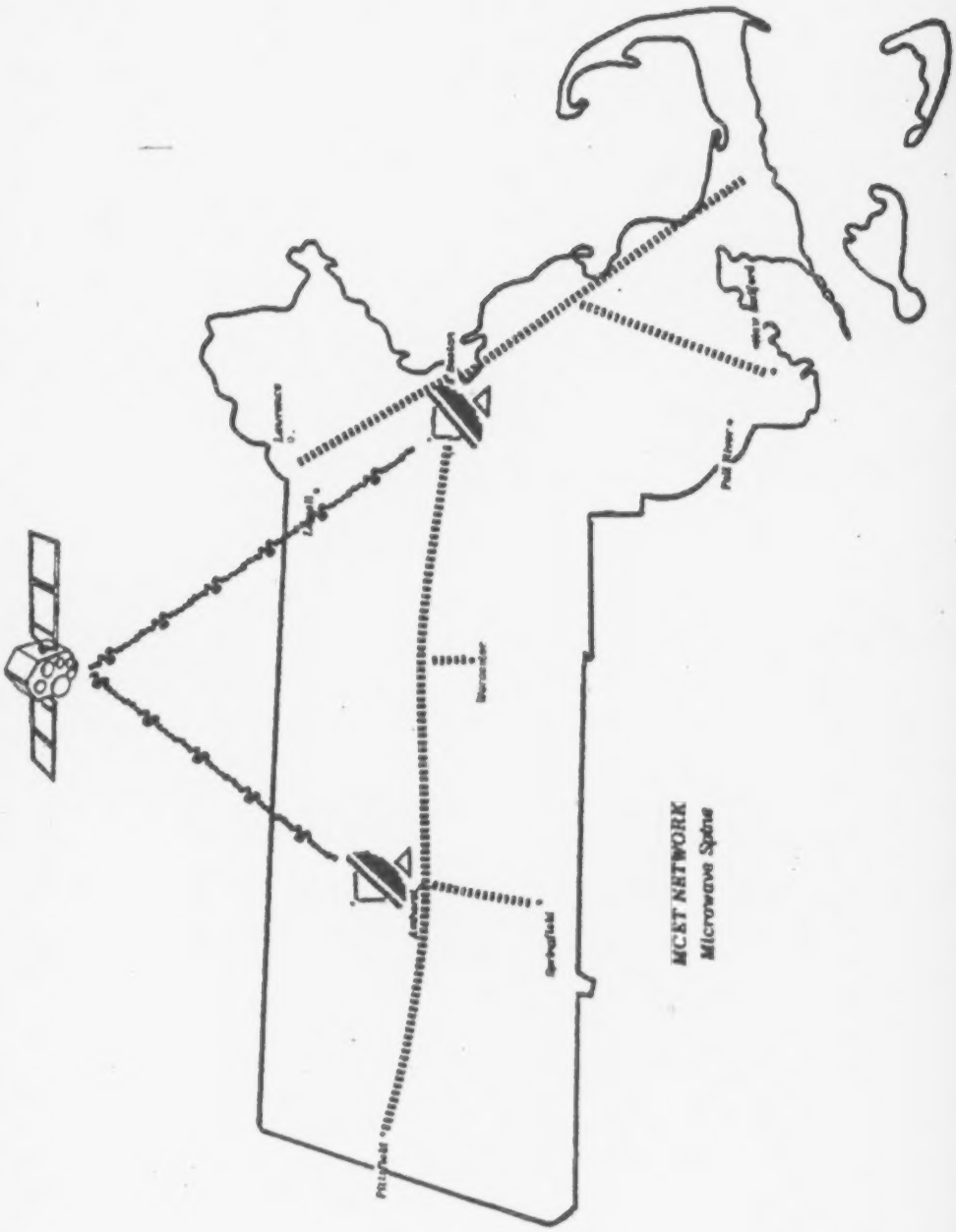
In this regard I want to talk about the Massachusetts Corporation for Educational Telecommunications. Within the last decade we have seen telecommunications applied to education in several parts of the country. When I was at the National Endowment for the Humanities, I tried to provide support for programming for the network in Kentucky which serves part of Appalachia (established with help from the Federal Government to serve as a regional model). The state of South Carolina also has an excellent educational television network.

In Massachusetts, we are trying to address the issue of the educational use of telecommunications in terms of the new technology and the shortcomings of some of the existing networks. The approach we have taken involves the cooperation of public and private universities, public agencies, health and medical centers and regional business and industry.

We seek to establish a highly innovative, state-of-the art regional educational telecommunications network under the auspices of the Massachusetts Corporation for Educational Telecommunications (or M-CET) along with Boston University and the University of Massachusetts.



MCET NETWORK
Satellite Penetration - All School Districts


MCET NETWORK
Microwave Spine

I SHOULD NOTE THAT MCET IS A PUBLIC INSTRUMENTALITY CREATED BY THE MASSACHUSETTS LEGISLATURE WITH A MISSION TO DEVELOP AND OPERATE A TWO-WAY VOICE, DATA AND VIDEO EDUCATIONAL TELECOMMUNICATIONS NETWORK SERVING THE NEEDS OF SCHOOLS, HIGHER EDUCATION, INDUSTRY AND OTHER SECTORS.

Telecommunications Can Help Solve Educational Problems

I STRONGLY BELIEVE THAT MANY OF THE PROBLEMS FACING ALL LEVELS OF EDUCATION --- K THROUGH 12 SCHOOLS, INSTITUTIONS OF HIGHER LEARNING, AND CONTINUING EDUCATION INVOLVING EFFORTS TO KEEP OUR WORKFORCE AT THE HIGHEST LEVELS OF PRODUCTIVITY AND INNOVATION --- CAN BE ADDRESSED THROUGH THE APPLICATION OF ADVANCED TELECOMMUNICATIONS TECHNOLOGY.

THAT TECHNOLOGY, I SHOULD NOTE, IS FAR DIFFERENT FROM WHAT WAS AVAILABLE TO EDUCATORS JUST 10 OR 20 YEARS AGO. WITH THE ADVENT OF SATELLITE TECHNOLOGY; THE ABILITY TO "ADDRESS" TELEVISION SIGNALS TO SPECIFIC, TARGETED AUDIENCES; THE DEVELOPMENT OF "INTER-ACTIVE" COMMUNICATIONS; THE MERGING OF COMPUTERS AND TELEVISION; AND OTHER INNOVATIONS, AN EDUCATIONAL TELECOMMUNICATIONS NETWORK CAN ENABLE US TO:

- SHARE SCARCE TEACHING RESOURCES;
- OVERCOME MANY OF THE FACTORS --- SUCH AS DWINDLING ENROLLMENTS, SCARCITY OF QUALIFIED TEACHERS AND LACK OF FUNDING --- CONTRIBUTING TO THE PERSISTENT EDUCATIONAL GAP BETWEEN "HAVE" AND "HAVE NOT" COMMUNITIES;
- PROVIDE TEACHERS WITH READY ACCESS TO PROFESSIONAL CONTINUING EDUCATION; AND
- GIVE STUDENTS AND TEACHERS WITH ACCESS TO RESOURCES AND MATERIALS THAT THEY DO NOT NOW HAVE.

FOR PRIMARY AND SECONDARY SCHOOL STUDENTS, TELECOMMUNICATIONS CAN PROVIDE ADVANCED SCIENCE, MATH AND FOREIGN LANGUAGE COURSES WE CANNOT AFFORD TO OFFER AT EVERY INDIVIDUAL SCHOOL. HIGH SCHOOLS THROUGHOUT MASSACHUSETTS ARE BEING FORCED TO DROP COURSES IN SPECIALIZED SUBJECTS, DUE TO DECLINING ENROLLMENTS AT THE HIGH SCHOOL LEVEL AND A SHORTAGE OF QUALIFIED TEACHERS IN SOME SUBJECT AREAS.

FOR TEACHERS, THE NETWORK CAN ENABLE THEM TO CONTINUE THEIR TRAINING AND KEEP UP WITH RAPID CHANGES IN SUCH FIELDS AS SCIENCE AND COMPUTER EDUCATION.

FOR COLLEGE FACULTY AND STUDENTS --- EVEN AT THE LARGEST RESEARCH UNIVERSITIES --- THE NETWORK CAN PROVIDE CURRENTLY UNAVAILABLE ACCESS TO INFORMATION AT OTHER INSTITUTIONS --- OR THE OPPORTUNITY TO COLLABORATE WITH COLLEAGUES HUNDREDS OF MILES AWAY.

FOR THE INDUSTRIAL WORKFORCE, TELECOMMUNICATIONS CAN PROVIDE CONTINUING EDUCATION COURSES IN ADVANCED ENGINEERING, COMPUTER SCIENCES AND BUSINESS SUBJECTS THAT ARE URGENTLY NEEDED IF OUR REGION AND OUR COUNTRY ARE TO COMPETE SUCCESSFULLY.

AND FOR HEALTH CARE WORKERS, THE NETWORK CAN PROVIDE SHARED CONTINUING MEDICAL EDUCATION PROGRAMS.

THE MCET NETWORK WILL SERVE ALL SECTORS -- PRIMARY AND SECONDARY SCHOOLS, PUBLIC AND PRIVATE HIGHER EDUCATION, INDUSTRY AND HEALTH CARE -- THROUGHOUT NEW ENGLAND.

THE REGIONAL TELECOMMUNICATIONS NETWORK WE PROPOSE CAN CREATE NEW ECONOMIES OF SCALE AND ENABLE US TO DERIVE MAXIMUM BENEFIT FROM NEW ENGLAND'S MOST VALUABLE RESOURCES --- TEACHING EXCELLENCE, CREATIVITY AND INFORMATION.

THE NETWORK CAN HELP FORGE NEW ALLIANCES BETWEEN ALL LEVELS OF EDUCATION, INDUSTRY AND GOVERNMENT AIMED AT SHARING RESOURCES AND INFORMATION, SO THAT WE CAN BETTER MEET THE CHALLENGES THAT FACE US NOW AND IN YEARS TO COME.

I VIEW THE PROPOSED NETWORK AS AN INVESTMENT IN OUR FUTURE --- AND AS A MODEL FOR OUR ENTIRE NATION.

4061c

RESPONSES OF DR. JOSEPH DUFFEY
Chancellor, University of Massachusetts at Amherst

To the Questions of
SENATOR CLAIBORNE PELL

Senator Pell: Do exemplary educational telecommunications programs currently exist, and if so how are they currently being transmitted?

Dr. Duffey: *Yes, there are some very effective existing educational telecommunications programs that transmit via a variety of technologies including Instructional Television Fixed Service, microwave, cable television, telephone lines, satellite and other technologies.*

Certainly, the Higher Education Cable Television Council that delivers college programming in your home state of Rhode Island is an example of an effective system. Likewise, the systems described by the representatives here from South Carolina and Minnesota have been effective in providing courses to rural public schools in their respective states. And systems like "TAGER" in the Dallas-Fort Worth area are effective in providing courses to the high technology industry.

But by and large, these systems do not have the scope and range that we are talking about. They usually cover only a small part of a state; they are almost invariably transmitted through technologies that do not allow programs to be targeted to specific audiences, to be encrypted, or to be transmitted over broad geographic areas without interference from mountains or even tall buildings.

Moreover, I know of no existing system that brings together or proposes to serve the wide range of sectors we propose to have participating in and served by our telecommunications network. Nor do I know of any that currently utilizes all of the state-of-the art advanced telecommunications capabilities of encryption, interactivity and addressability.

Senator Pell: How much teacher training is required to use telecommunications effectively? Are teachers involved in the development of these training programs?

Dr. Duffey: *Teachers can learn to supplement their own classroom instruction with telecommunications-delivered programming in a matter of hours. As they become more experienced, they develop their own increasingly effective and imaginative ways of integrating "in class" instruction with "telecommunications instruction." They can also learn to develop their own programming, with the help of technical professions, in a few days.*

A key element of the proposal offered by the Massachusetts Corporation for Educational Telecommunications is the development of regionally located Technology Resource Centers, where school teachers and college professors, industry specialists and technical experts can work collaboratively to develop programming that works best for both students and teachers.

Through a series of demonstration projects, we have already involved teachers in this development process --- and they have responded enthusiastically and creatively.

Senator STAFFORD. Thank you very much, Dr. Duffey. This is a very interesting discussion. I am sure the Committee will appreciate your comments and I certainly have, with the privilege of being here personally during your testimony.

Senator Kennedy has arrived and so I will conclude my role here by thanking GTE for providing the examples of present telecommunications equipment that are here in the hearing room with us.

Senator Kennedy?

The CHAIRMAN [presiding]. Thank you very much, Senator Stafford. I think those of us on the Education Committee, as our good friend, Claiborne, still refer to Senator Stafford as "Mr. Chairman" in terms of education as he has been so strongly committed.

Senator Stafford, at a field hearing up in Massachusetts, we had Latty Coor testify, who is the President of the University of Vermont. We extended your best wishes to him and he made interesting comments about his strong belief in what this would mean not only in the State but in many of the underserved areas, particularly as it would apply not only to Vermont but in the northern areas, New Hampshire and Maine.

I am sorry that I was necessarily absent from the earlier part of the hearing. We are familiar with this subject matter, since our Committee as a whole has been addressing some form of it for a while now. This will be the third time that we have had an opportunity to look at it, granted, each time from a somewhat different dimension. I think that this is important since it is innovative and I am sure that our colleagues in the Senate are going to be interested in the kinds of reactions that we are getting here this afternoon and that we have been able to get previously before the Committee.

I will make my other comments later in the hearing. I have a statement that I will——

Senator STAFFORD. Dr. Duffey did offer a list of schools and other activities interested in this program and I think that should be made part of the record.

The CHAIRMAN. Fine. It will be made a part of the record.

Mr. Cauthen, I hear you have been very eloquently presented already. I doubt if any of us could duplicate Strom Thurmond's introduction, but we look forward to hearing from you.

Mr. CAUTHEN. Thank you, Mr. Chairman. Senator Thurmond did indeed give me a very eloquent introduction. I hope I can live up to it.

Following Dr. Duffey, I must say that Dr. Duffey has done a tremendous amount for educational broadcasting in his previous life as Chairman of the National Endowment for the Humanities, and I want to thank him for that. I am glad to see that he is continuing to do good work on behalf of educational broadcasting in the country.

Mr. Chairman, I want to thank this Committee and thank you for the initiative you are taking to move communications technology to the forefront in dealing with some of our country's most perplexing problems in education and reeducation.

It seems to me that it is ironic that our country has led the world in the development of communications technology and yet we have hardly used it at all to bolster an education system that is

proving woefully inadequate to prepare our country to meet the challenges presented by what is an increasingly complex figure. This simply has got to change if we are going to rebuild our position of world leadership in education and commerce.

Fortunately, some of the solutions are within our grasp. Let me tell you about the educational communications system that has been painstakingly developed over a number of years in my own State of South Carolina. And I point out that it is one of our country's least affluent states.

Our system provides instructional television to the schools of our State, including elementary, secondary, institutions of higher learning, and technical training facilities, and many other areas. We have recently started a highly effective service for day-care centers, which makes the time spent each day by children in these centers a learning experience rather than just babysitting.

Today, more than 17,000 South Carolina teachers use instructional television in 93 percent of our schools, serving more than a half million students.

South Carolina teachers are able to select from 193 instructional television series. This catalog right here contains materials that we present to South Carolina schools throughout the year. Unfortunately, many of these courses are over fifteen years old, and that is one of the problems that we face in the use of educational technology in our schools.

The continuing educational needs of South Carolina teachers are being served through a variety of communications methods, including broadcast television, closed-circuit television, video teleconferences, and satellite seminars and workshops.

In higher education, we work closely with private and State-supported colleges and universities to deliver 90 college credit courses to more than 4,000 students on both open and closed circuit. Two master's degree programs are offered in business administration and engineering. In South Carolina, the University of South Carolina offers more master's degree and business administration through television than they do on the campus, which I think is a significant indication of what telecommunications can and even must do. Much of the content uses an interactive format, with an audio bridge that is computer controlled and allows the student to communicate with the instructor in the classroom.

Beyond our work in the public schools, we produce and transmit a comprehensive schedule of post-graduate courses for professionals. These events are typically presented in video conference format, with two-way audio links to classrooms across the State. Content includes law, medicine, dentistry, pharmacy, law enforcement, correctional institution training, and many other fields where instructional telecommunications techniques is the only way we can offer statewide educational opportunities, and they provide each access for students and it is very, very cost effective.

We do our voter education program for our voter registrars each election year and that saves the State $1.2 million because we do it through television.

Teleconferences are used extensively throughout State government in South Carolina for training and management communications. These teleconferences allow State government officials and

State workers to be kept up to date on the needs of State government and they save the State millions of dollars each year over traditional means of doing this job.

South Carolina's approach to distance learning employs a variety of available communications technologies. Over the years, we have developed a system that includes eleven open circuit broadcast channels, a statewide four-channel closed circuit television network that serves more than 500 sites statewide, and we have a seven-station statewide educational radio system. We operate multiple satellite downlinks and uplinks on C and Ku bands. A statewide multichannel microwave system allows us to interconnect cities throughout South Carolina for two-way television conferences and classes. The major teaching hospitals in our State regularly share information in five-way live video formats. They do ground rounds, they discuss very difficult cases and do diagnosis through television, and this is distributed to hospitals throughout our State on a one-way video, two-way audio format. So 11,000 health professionals receive training in South Carolina each month through the system.

These are just samples of some of the initiatives that we are taking for the use of telecommunications in South Carolina. We have a very interesting and I think important new initiative that we call the Palmetto Scholars Project. It is to provide master teachers for college-level courses for advanced placement of high school students in math, science and foreign languages and other essential areas. It is designed to challenge our brightest and our best students, no matter where they are located, in the largest cities or in the most remote rural classrooms.

A central part of the project includes the identification of students who have an aptitude and interest in teaching. High-achievers will be offered college scholarships as an incentive to teach in the areas of our State where they are most needed.

We believe a positive emphasis in teacher education as a quality profession will encourage South Carolina's best and brightest to become teachers, and we think that is an important part of the future of our State.

All of this is being achieved—and I would like to point this out and underline this—for less than one percent of our State's educational budget, all of what I am talking about, the eleven television stations and multi-channel closed circuit network, the satellite interconnection, the radio network, the teleconferencing, all for less than one percent of our State's education budget.

If South Carolina, as I pointed out, one of our country's least affluent States can develop a system of this enormous capacity and sophistication, then there is no reason that such systems cannot be developed throughout the country, particularly if the kind of Federal assistance you are proposing is made available.

In fact, 26 States have networks in various stages of development. For example, Kentucky is developing a statewide satellite distribution system; Oregon, a statewide ITFS system, and many other cooperative efforts are under way now.

In short, South Carolina and a number of other States represent ideal laboratories for the testing of virtually any telecommunications technology in support of education. The progress to date, however, has been far too slow and the resources far too limited, and

that is the reason I am so terribly excited about what you are doing today.

This needs to be supported as a national initiative if we are to remain competitive and regain our leadership. in commerce and technology, and I think all of you know how far this country is now lagging behind and I think it is a national disgrace that we are not taking full advantage of the technologies that are available to us.

I thank you so very much for you are doing to bring this to the attention of the country. The communications technology is already there. Additional satellite transmission time can be bought at reasonable prices and the Nation's public broadcasting system provides the framework and the foundation from which such services can be developed.

What we are most in need of at this time is funding to develop quality formal teaching materials in sufficient quantity to meet the rapidly increasing needs of education. I held up that book, and more than half of those courses should have been retired many years ago.

South Carolina would be glad to share our experience and our resources with this Committee and any other group that wants to move forward with the use of telecommunications to serve our country's needs, and there is an infrastructure of four regional networks that cover this country that are also working in this area and I am sure would be happy to cooperate with the initiative that you have undertaken, Senator, I thank you very much for this opportunity to share our experience with you.

I would be glad to respond to any questions that you might have. Thank you.

The CHAIRMAN. Before the questions, I think we will finish out the panel.

Mr. Kitchen, Vice President of Tele-Systems, from Minneapolis.

Mr. KITCHEN. Thank you very much, Mr. Chairman. I appreciate this opportunity to speak.

America's rural communities are facing increased challenges to provide equitable services and economic stability. Geographic distances, isolation, shrinking population bases, and even inadequate telecommunications infrastructures and relates services are all obstacles that rural communities must overcome to attain economic and educational parity with urban areas. As a result, rural communities are placing more significance on cooperation.

Today, a unique cooperative concept is emerging between two important world resources, the public school systems and local telecommunications providers (telephone companies, utility companies, cable television companies). Rural school districts and post-secondary institutions can cooperate with other regional educational entities to share limited financial and educational resources. State curriculum mandates, lower funding levels, and limited staff make it difficult for rural schools and many urban schools to provide equitable and comprehensive educational opportunities to the areas they serve.

Thus, a potentially inadequate telecommunications infrastructure, combined with the lack of educational opportunities and resources, emphasizes the need for rural educators and local telecommunications providers to work together. Such cooperation means

sharing telecommunications networks to provide educators with an alternative delivery system for two-way interactive television or ITV to interconnection multiple school locations. ITV systems are designed so that a teacher may teach from any school by transmitting at least one channel of audio and video to other classrooms in any number of other school sites or communities.

Each classroom or school site is also capable of receiving all of the other classroom's video and audio signals simultaneously. These ITV systems offer an educationally effective method of delivering distance education to clusters of cooperating schools. With ITV, a teacher in one district can now teach a course in which students may be located in three or more remote locations. Using television cameras and monitors and a microphone system in each classroom, the teacher can see and hear all of the students. All of the students are then able to see each other and all of the students will see and hear the teacher.

By forming a unique and mutually advantageous business-education partnership, both parties share the costs and the use of the system. To understand how such partnerships work, it is helpful to examine one recently developed fiber optic project in Minnesota. It is listed up there in the orange.

The first fiber optic telecommunications partnership was formed between a rural telephone cooperative, which has approximately 400 customers, and a consortium of seven Minnesota school districts. The Upsala Telephone Cooperative from Upsala, Minnesota, and the Mid-State Educational Telecommunications Cooperative [MSET] joined forces to interconnection these school districts via a 78-mile fiber optics network to provide an ITV system for educational use and an upgraded telephone system for the Upsala cooperative's use. The MSET system is currently delivering 16 high school classes, preschool and parenting classes, community education programming, and college classes in their first full year of operation.

Indicative of the growing involvement and interest in telecommunications networks similar to the previous example is that over 40 percent of Minnesota's 433 school districts and a majority of its post-secondary institutions are currently exploring the development and implementation of two-way interactive television networks. By the fall of 1987, an estimated 90 schools in Minnesota will be delivering educational programming through these two-way interactive networks. I personally have worked with or know of projects and interest in 35 States listed on the chart that is now being put up.

Minnesota, Michigan, Connecticut and New York are the States that I am aware of that are doing the most with two-way interactive television.

From 1983 to 1986, the Minnesota State Department of Education conducted extensive research on the eleven technology demonstration sites that implemented ITV. The results and findings of this evaluation confirm the effectiveness and the importance of telecommunications in education. The following summarizes the Minnesota findings:

ITV allows schools to offer a wider range of elective courses and permits students greater access to subject matter.

ITV requires cooperation among schools. While difficult, this has led to improved programming which individual schools acting alone would have found difficult or impossible to provide.

Teachers require training, preparation and support to deal successfully with teaching on ITV. When these factors are present, teachers can adapt to and enjoy teaching on ITV. Seventy-five percent of the teachers who taught on ITV in Minnesota would choose to do so again.

Students enjoy learning on ITV and are motivated by it.

No systematic, statistically significant difference in achievement was found between students taking courses traditionally and those in ITV sections. The medium does not appear to influence achievement.

ITV seems to be particularly appropriate——

The CHAIRMAN. Do you want to submit those reports?

Mr. KITCHEN. Yes, we did. As a matter of fact, I submitted the entire findings on the research that Minnesota did.

ITV seems to be particularly appropriate for language and math instruction, for which it is heavily used.

ITV is relatively expensive as a delivery system. However, costs are being reduced due to business/education partnership, cooperative purchasing and planning, and changes in the technology itself.

Some final observations about technology in education: The implementation of technology in schools is inevitable. Society relies on technology, and parents, students, educators and employers demand that students be exposed to and become competent in its use.

Technology clearly has a place in schools. Educational uses of technology are in their infancy. The importance of telecommunications technology as part of each community's infrastructure and as an economic development tool is only now beginning to be understood.

It is important that the Federal Government provide leadership and incentives to schools throughout the country in the area of telecommunications for the delivery of educational programming and economic development. This bill will act as a catalyst and mechanism for the practical, costeffective, and comprehensive development and implementation of two of America's most important resources, education and telecommunications.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Kitchen and responses to questions submitted by Senator Pell follow:]

TESTIMONY

ON

TELECOMMUNICATIONS IN EDUCATION

BEFORE THE

COMMITTEE ON

LABOR AND HUMAN RESOURCES

PRESENTED BY

WILL KITCHEN

VICE PRESIDENT

TELE-SYSTEMS ASSOCIATES INC.
11995 Singletree Lane
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MARCH 11, 1987

EDUCATION AND TELECOMMUNICATIONS: PARTNERS IN PROGRESS

America's rural communities are facing increased challenges to provide equitable services and economic stability. Geographic distances, isolation, shrinking population bases, and even inadequate telecommunications infrastructures and related services are all obstacles that rural communities must overcome to attain economic and educational parity with urban areas. As a result, rural communities are placing more significance on cooperation.

Cooperatives, of course, grew out of rural America. but now cooperative ventures may help rural areas compete with urban communities in the arenas of economic and educational development. Moreover, the cooperative philosophy can help achieve progress without compromising the special identity of rural America.

Today, a unique cooperative concept is emerging between two important rural resources - public school systems and local telecommunications providers (telephone companies, utility companies, cable television companies). Rural school districts and post-secondary institutions can cooperate with other regional educational entities to share limited financial and educational resources. State curriculum mandates, lower funding levels, and limited staff make it difficult for rural schools and many urban schools, to provide equitable and comprehensive educational opportunities to the areas they serve.

At the same time, the evolution of America's economy from manufacturing to information and services presents another obstacle to rural economic development. Businesses in the information sector are expected to create most of the new jobs in the future, and all businesses are becoming more dependent on telecommunications technologies for communications and information distribution. However, many existing rural telecommunications infrastructures may lack the capability to transmit cost-effective, high speed and high volume audio and video information.

Thus, a potentially inadequate telecommunications infrastructure, combined with the lack of educational opportunities and resources, emphasizes the need for rural educators and local telecommunications providers to work together. Such cooperation means sharing telecommunications networks to provide educators with an alternative delivery system for two-way interactive television (ITV) to interconnect multiple school locations. ITV systems are designed so that a teacher may teach from any school by transmitting at least one channel of audio and video to other classrooms in any number of other schools or communities. Each classroom or school site is also capable of receiving all of the other classroom's video and audio signals simultaneously. These ITV systems offer an educationally effective method of delivering distance education to clusters of cooperative schools. A teacher in one district can now teach a class in which students may be located in three or more different communities. Using

television cameras and monitors and a microphone system in each classroom, the teacher can see and hear all of the students, the students are able to seen and hear the teacher, and all of the students can see and hear each other. In addition, this cooperation can provide rural telecommunications providers with an opportunity to upgrade their infrastructure and become an important force in local economic development.

By forming a unique, mutually advantageous, business-education partnership or cooperative, both parties share the cost and the use of the system. To understand how such partnerships work, it is helpful to examine one recently developed fiber optic project in Minnesota.

The first fiber optic telecommunications partnership was formed between a rural telephone cooperative and a consortium of seven Minnesota school districts. The Upsala Telephone Cooperative from Upsala, Minnesota and the Mid-State Educational Telecommunications Cooperative (MSET) joined forces to interconnect these school districts via a 78-mile fiber optics network to provide an ITV system for educational use and an upgraded telephone system for the Upsala cooperative's use. The MSET system is currently delivering 16 high school classes, pre-school and parenting classes, community education programming, and college classes in their first full year of operation.

Indicative of the growing involvement and interest in telecommunications networks similar to the previous example is that 40 percent of Minnesota's 433 school districts and a majority of its post-secondary institutions are currently exploring the development and implementation of two-way interactive television networks. By the fall of 1987, an estimated 90 schools in Minnesota will be delivering educational programming through these two-way interactive networks. I personally have worked with, or know of, projects and interest in the 35 states listed on the chart:

Arizona
Arkansas
California
Colorado
Connecticut
Florida
Illinois
Indiana
Iowa
Louisiana
Maine
Massachusetts
Michigan
Minnesota
Montana
New Mexico
Nevada
Alaska
New Jersey
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Texas
Utah
Virginia
Washington
West Virginia
Wisconsin

From 1983 to 1986, the Minnesota State Department of Education conducted extensive research on the eleven Technology Demonstration Sites that implemented two-way interactive television. The results and findings of this evaluation confirm the effectiveness and importance of telecommunications in education. The following summarizes the Minnesota findings:

1. ITV allows schools to offer a wider range of elective courses and permits students greater access to subject matter.

2. ITV requires cooperation among schools. While difficult, this has led to improved programming which individual schools, acting alone, would have found difficult or impossible to provide.

3. Teachers require training, preparation and support to deal successfully with teaching on ITV. When these factors are present teachers can adapt to and enjoy teaching on ITV. Seventy-five percent of the teachers who taught on ITV would choose to do so again.

4. Students enjoy learning on ITV and are motivated by it.

5. No systematic, statistically significant difference in achievement was found between students taking courses traditionally and those in ITV sections. The medium does not appear to influence achievement.

6. ITV seems to be particularly appropriate for language and math instruction, for which it is heavily used.

7. ITV is relatively expensive as a delivery system. However, costs are being reduced due to business/education partnership, cooperative purchasing and planning, and changes in the technology itself.

OBSERVATIONS ABOUT TECHNOLOGY IN EDUCATION

1. The implementation of technology in schools is inevitable. Society relies on technology, and parents, students, educators and employers demand that students be exposed to and competent in its use.

2. Technology clearly has a place in schools.

3. Educational uses of technology are in their infancy.

4. The importance of telecommunications technology as part of each community's infrastructure and as an economic development tool is only now beginning to be understood.

It is important that the federal government provide leadership and incentives to schools throughout the country in the area of telecommunications for the delivery of educational programming and economic development. This bill will act as a catalyst and mechanism for the practical, cost-effective, and comprehensive development and implementation of two of America's most important resources: education and telecommunications.

Thank you Mr. Chairman.

SENATOR PELL'S QUESTIONS FOR WILL KITCHEN

1. Do exemplary educational telecommunications programs currently exist, and, if so, how are they being transmitted?

2. How much teacher training is required to use telecommunications effectively? Are teachers involved in the development of these training programs?

March 30, 1987

Responses from Will Kitchen to questions from Senator Pell:

1. Yes, there are a number of exemplary telecommunications projects currently operational. There are systems that effectively use microwave, coaxial cable, fiber optics, satellite and combinations of these technologies. I have enclosed brief overviews of several such projects.

   A. MSET - Fiber optics
   B. ECMECC - Coaxial Cable - Microwave
   C. Sibley County - Coaxial Cable

2. In the recent evaluation performed by the Minnesota Department of Education of 15 Technology Demonstration Sites, appropriate staff training was one of the most important aspects of a successful project. Minnesota, Michigan, Connecticut, and Montana currently offer training sessions which last from 3 - 5 days depending on the number of teachers involved. Teachers have been actively involved in the design and implementation of these training sessions, and are encouraged, and in most cases required, to participate in training prior to actually teaching via two-way interactive television. Hands - on, guided practice with experienced teachers has proved to be very effective.

INTERACTIVE TELEVISION
FINDINGS, ISSUES AND RECOMMENDATIONS

An Analysis Based on Evaluation of
Minnesota's Technology Demonstration Program

February 1, 1987

QED
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Mary L. Hoaglund
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INTRODUCTION

Interactive Television for instruction? What is it? How does it work? What kinds of impacts have been achieved by school districts investing in this new technology? Many school districts in Minnesota are considering the implementation of interactive television, yet little published evaluation documentation is available.

This short report is a compilation of findings from Minnesota's Technology Demonstration Sites. These sites were funded as part of a major initiative in technology enacted in 1983 by the Minnesota Legislature. The Technology Demonstration program was designed to promote greater and more effective use of technology in Minnesota school districts.

Findings are drawn from an evaluation of the program which was required in statute. Conducted over a three-year period, the evaluation was designed to 1) account for the expenditure of state funds, 2) assess and describe the impacts of the program, and 3) provide information to assist policymakers and other educators in planning, funding and implementing programs of technology use. A number of evaluation reports have been produced. This is one of several short documents which describe the applications and detail the evaluation findings of a particular use of technology in education, in this case Interactive Television (ITV).

The Technology Demonstration Sites which used ITV to provide simultaneous instruction to students in two or more schools or school districts are described in the table on page three.

How does it work?

Interactive Television can employ a number of technologies - cable, broadcast options of various kinds, fiber optics, etc. Moreover, systems can and do use these options in combination. Regardless of the technology used, each system basically allows a teacher in one location, with or without students present, to be simultaneously seen and heard by students in one or more remote locations. Students in each site can similarly respond to the teacher and to one another. The allowable distance between sites is dependent on the type of technology. The classroom in which the teacher is located is known as the live or host site; students are in receiving or remote sites. Classes are typically limited to 18 students or fewer in up to three districts.

While projects differ, both in the technology used and in the set-up of the interactive classrooms, each uses a teaching station with an overhead camera which the teacher uses to display visual material, and has cameras mounted around the classroom, allowing students in remote sites to see the teacher, the host/teaching site class (if any) and the blackboard. Each also has two or more monitors on which the teacher is able to see the students in the remote sites. Most projects have a switchboard at the teaching station which allows the teacher to tune in on the remote sites; others have automatic switching.

Each of the remote site classrooms in a project or system is similarly equipped, so that instruction can be provided from any of the interactive classrooms. Students in remote locations see the teacher and their classmates on two or more monitors in the front of the classroom. The teacher is able to see his/her

remote site students through a camera which is focused on them and which they are able to move on request. Microphones in each location allow voice communication. Typically, the remote sites do not have an adult physically present for supervision, nor do they require camera operators - although some have chosen to do so.

Materials (tests, student work, etc.) are either transmitted using facsimile machines (a photocopying machine that transmits over telephone lines) or through the mail.

The technology used in these projects seems to be more a function of community resources, long range plans and the availability of outside support, than of the merits or disadvantages of a particular technology. For example, if a local or regional cable company is willing to cooperate and share equipment and resources, the system will likely employ cable. Each of the options has both advantages and disadvantages, and the range of options changes/expands as new technologies become available. Rapid obsolescence is a problem in all new technologies. The list below provides an indication of just a few of the advantages and disadvantages of each.

CABLE:	ADVANTAGES	DISADVANTAGES
	Not significantly affected by weather	Unavailable in rural areas
	Can involve significant cost-savings through parterships with industry	Subject to disruption of service by excavation
	Available in many communities	Involves negotiation with industry
	Locally franchised and regulated	Negotiation can be time-consuming
	Multi-channel capacity	
	Visual and data transmission	

BROADCAST:	ADVANTAGES	DISADVANTAGES
	Can provide service to all within a service area	Affected by terrain and weather
	Can serve areas not served by cable	Requires towers; expensive
	Can utilize broadcast frequencies specifically designated for education	FCC regulated and licensed
	Several broadcast options	Can involve cost-savings and allow expanded service through partnerships with public broadcast

FIBER OPTICS:	ADVANTAGES	DISADVANTAGES
	Multiple channel capacity	Very expensive
	Unaffected by weather	Few manufacturers; not easily available
	Less subject to noise and interference than copper cable	
	Being used by an increasing number of utilities; may allow school-industry partnerships	

TABLE ONE
TECHNOLOGY DEMONSTRATION SITES

PROJECTS DEMONSTRATING INTERACTIVE TELEVISION

Fiscal Agent and Project Title	Number Participating Districts	Technology(ies) Demonstrated	First Year Of Operation
Bloomington Information Technology System	1	Closed Circuit Cable Satellite	1984-1985
Cambridge East Central Minnesota Educational Cable Cooperative	7	Cable - AML Microwave Satellite	1984-1985
Montevideo Minnesota Valley Tele-Network	9	Broadcast - ITFS Microwave	1985
Austin Southern Minnesota High Technology Cooperative	2	Broadcast - Microwave	1984-1985
St. Peter Knowledge Interactive Distribution System	5	Broacast - Microwave	1985-1986
Little Falls Mid-State Educational Telecommunications Cooperative	7	Fiber Optics	1986
Wright County Voc. Ctr. Sherburne-Wright Educational Telecommunications Cooperative	8	Cable	1986-1987
Sibley County Voc.Coop. Sibley County Technology Demonstration Site	4	Cable	1986-1987
Luverne Southwest Minnesota Telecommunications	10	Broadcast - ITFS	1987
Woodland Coop Communicasting for Educational Purposes	5	UHF Low Power - ITFS	1983-1984

FINDINGS

The following narrative provides an abbreviated overview of evaluation findings. The reader is encouraged to review the **TECHNOLOGY DEMONSTRATION PROGRAM FINAL EVALUATION REPORT - 1985-1987**, its separately bound appendices containing numerical data, and the reports available for each individual TDS project.

I. Effects on School Districts

ITV affects school districts in at least three ways: one, it requires that they cooperate with others, allowing the sharing of expertise and resources; two, it permits school districts to offer an enlarged curriculum/program to students; and three, it allows expanded community and adult education. While construction and implementation costs are high and, as will be noted, systems require careful planning and and implementation, ITV has permitted the continued survival of smaller school districts whose limited programs might have forced them to pair or consolidate programs.

It must be emphasized that while the overall net effect on school districts involved in the ITV projects is positive, there are certain costs involved. Actual expenditures for system construction and installation are quite high, although financial help has been available through such mechanisms as Interdistrict Cooperative Aid/Levy, state and federal grants, and the significant cost-sharing which has resulted from cooperation with franchised cable companies and regional utilities.

There are other non-monetary costs. For these cooperative efforts to work, school districts must relinquish a degree of local autonomy; such things as school calendars, daily schedules, course and grading requirements, registration processes and prerequisite background must be agreed to by all districts participating in ITV classes. Systems must be carefully planned, and very careful attention given to the involvement and preparation of teachers. Administrative and student support staff must be involved and most projects have found it important to involve adult and community education staff as well.

All aspects of ITV projects require time, careful planning and significant adjustments in both procedure and attitude.

II. Effects on Teachers

Participating teachers are generally favorable toward the use of this technology. While only half those now teaching on TDS-funded interactive systems felt their decision to teach was entirely voluntary, 75% would choose to teach again on a system.

Teachers believe advantages of these systems include: enlarging programs and course options for students, providing challenge and growth opportunities for teachers, providing motivation and opportunities to build self-discipline among students, and the smaller class sizes which seem to be typical (usually 18 students or fewer).

Teachers believe that participating students like their televised classes, learn about as much as in traditional classes, spend about as much time on task as in traditional classes, and that they are frequently more motivated and responsible in interactive situations.

However, many teachers also feel that cheating is more frequent in the unsupervised remote site interactive classes. Nearly half the teachers also believe that there are more discipline problems in ITV classes.

Other disadvantages include: lack of personal contact with students leading to absence of control, movement and space restrictions, technical problems, delays in materials transfer, problems with the logistics of make-up work, and conflicting school schedules (e.g., announcement interruptions, daily or weekly schedule differences).

Seventy percent of those now teaching in TDS interactive projects believe these systems have required them to change their style or method of teaching, described as simultaneously a problem and an opportunity. Better advance preparation, more preparation time, more or different visual materials, and more work to keep all students involved and attentive are clearly required of teachers. Moreover, it is the observation of the evaluators that these systems tend to magnify both good and bad teaching, and do require a degree of "presence" camera.

Teachers find that interactive sytems require practice, and time and support to allow them to become familiar with and comfortable on the system. Inservice, with extensive hands-on work with equipment, feedback from peers, and follow-up support, is mandatory. Teachers also believe that ITV requires them to use a variety of interaction and teaching techniques, many of which need to be "practiced."

III. Effects on Students

Attitude. Students, too, have generally favorable attitudes to ITV classes after a short initial adjustment. A majority enrolled in these classes have done so because they thought it would be an "interesting way to learn." Just 30% said they took the TV class because it was the only way they could get the credits/courses they needed.

Students indicate they generally are comfortable, can see and hear the teacher and each other, and talk to the teacher as often as they wanted. Most believe that instruction is appropriately personalized, and that teachers do not pay differential attention to the live and remote sites.

Most indicate they enjoy opportunities to interact with and get to know students from other districts.

Students are somewhat mixed in their opinions about cheating and classroom discipline. Asked if discipline and cheating are greater problems in the ITV classes, 50% say no, but the others either don't know or feel they are.

Roughly half the students dropping out of ITV courses either didn't like the teacher or felt the course was too hard. However, 55% indicated that television had some or a lot of influence on their decision to drop. It would appear from comments that those experiencing academic difficulty find that ITV classes exacerbate those difficulties. It is often hard to keep up with content or have questions answered, students report. A slight majority of those dropping indicate they would take another class on TV.

Achievement. Data support teachers' assertions that achievement in traditional and ITV classes is equivalent. A comparison of grades received in English (required) classes with those received in foreign language ITV classes indicates that grade distributions are similar. Fifty percent received the same grade in English and the foreign language; and another 40% received one grade higher or lower.

Additionally, both final class grades and unit test grades for ITV and traditional classes taught by the same teacher were compared. The overall mean final grades for ITV classes was 2.99. The mean final grade for traditional classes was 3.0. Unit test data are similar; the mean unit test grade in ITV classes was 2.73 and 2.74 in traditional classes. These data strongly suggest the medium does not significantly affect academic achievement.

Classroom climate and interaction. The evaluation team spent considerable time observing and charting interaction patterns in ITV classes and subsequently observing the same teacher in a traditional setting. The purpose was to discover whether ITV and traditional classes are different from or similar to one another - to test the operating hypothesis that ITV and traditional classes are "the same."

Items observed and tabulated were: questions asked by teachers and students; questions answered by teachers, students and the group, comments, chit-chat or extraneous conversation, discipline or control statements, directions given, demonstrations and presentations by teachers and students. Also analyzed were differences in these items between live/host and remote sites. A total of 36 ITV and 36 traditional classes - taught by the same teachers - were observed.

A great deal of interaction between students and teachers is taking place in these classes. The mean number of observed interactions in ITV classes was 261 and 270 in traditional classes.

These are clearly on-task teachers and classrooms. Using the average of 261 interaction units per ITV class, this amounts to a different interaction every ten seconds for a fifty minute period. It should be emphasized, however, that because of the high representation of foreign language classes, many of the interactions were at a low level on Bloom's taxonomy, which is appropriate.

Teachers did not lecture in these classes. Roughly two percent of the interaction units were presentations, which rarely lasted more than five minutes. Information tended to be delivered more by comments, 17 to 18% of the interaction units.

Despite what teachers and students say about control or discipline, the control of student behavior through verbal interaction by the teachers was less than one percent

Only one significant difference was found between the ITV and traditional classes. The reason for this lies in the wide variability among individual teachers and the number of total interactions tabulated. The range, for instance, of total interactions was a low of 79 to a high of 655. Some teachers tend to be very interactive, involving students a great deal, others do not. The medium of instruction, however (ITV or traditional classroom) appears to have little or no impact on levels of interaction.

The evaluators conclude that a higher degree of interaction correlates with a higher degree of student involvement in classes. Moreover, the evaluators conclude that television seems to magnify a number of things, including "dead" time, personal and teaching styles, and the effectiveness of a good teacher and the weakness of a poor one. It is fair to conclude, as well, that those who are highly interactive and involving in traditional classroom settings will be successful on television.

IV. Costs

While, as the foregoing makes clear, interactive television is generally effective and well received, and permits the expansion and improvement of programs, it must also be recognized that systems construction is expensive.

Planning and Construction costs (all equipment and first year costs) for TDS interactive television projects range from a low of $131,400 to a high of $1,082,805. The average cost for construction is $592,199; the median is $589,253.

Operating costs (excluding instructional costs) are more reasonable, assuming that large amounts of additional equipment are not required. Annualized operating costs range from a low of $36,500 to a high of $117,617. Differences are, in large measure, a function of differences in repair and maintenance costs. The average annual operating cost is $56,435; the median is $40,974.

This evaluation did not address issues of cost-effectiveness, given the difficulties associated with fair comparions of costs incurred in ITV programs and costs incurred in traditional forms of schooling. Clearly the significant costs of ITV systems must be weighed against the program and curricular advantages which occur, and the quite fundamental benefits accruing from students access to programs.

CONCLUSIONS

Interactive Television (ITV) represents a significant departure from the traditional methods of instructional delivery. As a new delivery system, there is much about ITV which is still unknown, and final conclusions about its instructional and cost-benefit cannot yet be drawn. However, experimentation and evaluation in ten TDS sites allows the following preliminary conclusions:

Interactive television allows school districts to offer a wider range of elective courses, and permits students access to subject matter which would otherwise have been difficult to access or unavailable.

ITV systems are being used extensively for community education, with college credit, professional development and general interest courses. Business and professional groups are beginning to express interest in also using systems. This would present possible opportunities for generating revenue.

Interactive television programs require that school districts cooperate with one another. This cooperation, while often difficult, has led to resource sharing and improved programming which individual districts, acting alone, would have found difficult or impossible to implement.

Teachers require training, preparation and support to deal successfully with teaching on ITV systems. All evidence suggests that when these factors are present, teachers can successfully adapt to and teach on ITV.

Students enjoy learning on TV and achieve at a similar level as in traditional classes. There is no evidence of statistically significant differences in achievement and/or in the rate of learning.

Students experiencing academic difficulty, while not citing television as the primary reason for dropping ITV courses, do indicate that ITV classes make it harder for them to understand content and keep up.

Teachers vary widely in their interaction and approach in ITV classes, as they do in their traditional classes. However, there are no statistically significant differences in the amount or the type of interaction in classes taught via television and those taught by the same teacher in more conventional settings. The medium does not appear to significantly alter interaction patterns. Any differences in levels of classroom interaction reflect individual differences among teachers.

ITV classes are typically on task a high percentage of the time, and there is little evidence that discipline is a major problem.

ITV seems to be particularly appropriate for language instruction, and is heavily used for this purpose. There may be other courses for which it is not appropriate, but thus far, the range of courses offered has been quite limited.

Interactive television technology works quite well, and few major interruptions are experienced. However, both students and teachers must be prepared for those inevitable occasions when weather or other situations disrupt broadcast and classes. In addition, most projects continue to experience problems with audio quality.

For the technology to work, teachers and other personnel must be trained, supported and encouraged. Without the active support and participation of staff, these systems do not work.

Teachers need to use a greater range of teaching style and material. To do so, at least initially requires additional preparation time.

ITV programs are an expensive alternative delivery system. While mechanisms exist for cost sharing, school districts should recognize that costs will be significant.

OBSERVATIONS

The range of available evidence leads the TDS program evaluators to conclude that ITV represents a workable alternative method of instructional delivery. These systems allow school districts to work cooperatively to provide a wider range of courses and programs to students. They may ultimately allow small school districts greater parity with larger districts. The programs have potential to provide even greater improvements in services to elementary/secondary and adult and community education.

However, several points should be noted. To date, the ITV projects supported through the Technology Demonstration Program have cost nearly $6 million in both public and private monies. Additionally, a large number of districts, not part of TDS, have implemented ITV systems. The total capital investment in interactive television has been significant.

There are, moreover, other issues. While participating teachers and students have successfully adapted to ITV, there are those teachers who remain unconvinced of the value of the technology, and those students for whom such remote delivery of instruction is ineffective. As is true in any alternative system, this does not work for all people in all situations.

ITV, like most of the technology scrutinized in this program, is in its infancy - there is much about it we do not yet know. It is, for example, not yet clear whether ITV represents a viable long-term and/or cost-effective alternative to school district pairing or consolidation.

While this optimism is tempered by a professional judgment that ITV is not for everyone, the evaluators strongly believe ITV is deserving of wider implementation and continued study. It is hoped the following observations and caveats will be considered:

1. Interactive television, like all technology, is a tool. Like all tools when skillfully used, ITV can be effective. In the hands of those unprepared for its use, it will not work. The preparation, involvement and support of teachers is critical to the success of interactive television.

2. Systems must be implemented only after careful planning, careful attention to the mutual needs of all participants, interaction with experienced users, and with patience.

3. If a district does not have a real program need, and the willingness to expend resources, time and effort in careful planning, it should look to other means for solving problems.

4. Cooperation with cable companies and/or other carriers is extremely important in terms of cost reducation and ease of implementation. Such cooperation is strongly encouraged.

5. Such new technologies as fiber optics have great potential for improving signal quality, and providing a greater range of technological options. There may be advantages in a) delaying implementation and b) entering negotiation with utilities to share fiber optic systems.

6. Thus far, systems have not, in the evaluators' judgment, been used to their full potential. Course offerings have been somewhat limited, and there is much that is not yet known about the instructional or systemic limitations or possibilities. Experimentation with age and grade levels, as well as course content is encouraged.

7. This particular technology has a tendency to magnify differences among individual teachers and students. Thus far, all evidence indicates ITV is most effective when courses are taught by highly interactive, engaging teachers, and when students are responsible and motivated. Evaluation procedures suggest that it is possible to predict which students and which teachers will be most likely to meet with success in use of the medium. It will clearly not work to its fullest potential by attempting to serve or involve everyone.

The CHAIRMAN. Thank you very much. I think it is very reassuring to find out what is happening in so many different parts of the country.

Let me ask all the panelists generally what the impact has been on the teachers and students in areas where you have had the most experience, and what has been the degree of acceptability, whether kids feel that they can use the technology and do not feel remote from participating in discussions and that sort of typical student activity? What can you tell us about their reaction? We are going to hear from a couple of students shortly and from some teachers, but I would be interested in what your own experience has been.

Mr. CAUTHEN. Senator, they have been almost universally positive in our situation at least. After all, we are dealing with the third generation of children who have gotten accustomed to getting most of their information from television. The education system is just beginning to catch up with the students in their ability to deal with information delivered through television.

Interactive television obviously offers some very unique opportunities and our higher education courses, all 90 of them, are interactive which allows the teacher and student to communicate, a very positive process.

The thoughtful production of instructional television materials that are carefully tested out before they are put in the classroom insures that most of the questions that might come up are essentially answered in the process. But one of the most important things, at least in our situation, is we stress that we put two teachers in the classroom instead of one, we always have a teacher in there to interact with the students when it is not a live, interactive program.

I find no problem at all in using television instruction and I think both teachers and students are enthusiastic in South Carolina.

Mr. KITCHEN. Senator Kennedy, let me just read a little bit from the research summaries that Minnesota just came out with as of February 1st of this year.

Effects on students, their attitude: Most of the students have a general impression of learning on two-way interactive television after a short initial adjustment of less than a week, and most of them found it was an interesting way to learn, and they also liked the fact that they could meet with and get to know students in other districts that they may not have had an opportunity to know before.

All of the students indicate they are generally comfortable, as was mentioned, this was the Sesame Street generation that we are dealing with and they are very used to learning on television. The achievement of students which I find most interesting is that the achievement in tradition and ITV classes is equivalent, according to the Minnesota findings, and that the classroom teachers are saying that they have become better teachers because they have more preparation and training for the use of the technology and because of the magical effect of television they prepare or they find themselves preparing more for that medium and again become better in the classroom.

There is a great deal of interaction. All of our systems that we develop the teacher can see and hear students, students see and hear the teacher, and there is a great deal of interaction. We feel that because of the remoteness one step away from the student that you need that interaction and we encourage in training sessions that type of teaching.

In most of the classes that we found, the teacher did not lecture. There was discussion, sharing of ideas, students talking and sharing ideas. There was a very positive educational experience for teachers and students.

The CHAIRMAN. Mr. Duffey?

Mr. DUFFEY. I certainly agree with both what Mr. Cauthen and Mr. Kitchen have said, and both Minnesota and South Carolina have been exemplary in providing the opportunities to train teachers to use the new medium. We are not talking about even 70 or 80 percent of education that will occur in the classroom with the teacher. We are talking about that very important margin of opportunity that simply wouldn't be there otherwise to hear or work with an outstanding scientist, to have someone who is perhaps even in an industry offer a class at high schools across the region. To have teachers trained to use the technology seems to me to be a formula for genuine learning and for raising the level of all the schools in a system that now is most noted, I think by, the differences in opportunities for our students. Those differences are certainly not in their level of ability, their curiosity, or their aptitudes. The differences are in the opportunities they have.

This network I think, provides that margin of opportunity for all our schools, and my observation and experience is that it works very well.

The CHAIRMAN. Okay. We appreciate your testimony here. We will have some additional questions as we develop legislation and I hope we can call on you again.

I want to thank you all very much for your presence here.

[Responses to subsequent questions to Mr. Cauthen follow:]

S. C. ETV RESPONSES TO SENATE QUESTIONS FOR HENRY CAUTHEN:
PRESIDENT, SOUTH CAROLINA EDUCATIONAL TELEVISION COMMISSION

SENATOR THURMOND

1. Do you find a shortage of qualified science, math, and language teachers in South Carolina? In the South generally?

A November 1986 study predicted shortages in the instructional fields of educable mentally handicapped, emotionally handicapped, and learning disabilities. The South Carolina State Board of Education in January, 1987 designated the areas of mathematics, science, library science and foreign languages as areas of critical teacher shortage for purposes of the Critical Need Conditional Certification Program.

2. Who decides what your system will distribute to the schools and colleges?

The Office of Instructional Technology, State Department of Education, is responsible for the development, acquisition, scheduling and utilization of television and radio resources for grades K-12. S.C. ETV works in cooperation with colleges, universities, technical education colleges, and business and industry in the production and delivery of college degree and training programs. S.C. ETV also produces and delivers training programs for day-care providers.

3. Who produces the video or computer materials which you distribute?

The S. C. ETV Netwo-k is responsible for producing about 25% of the programs used by the public schools and colleges in South Carolina. Other materials are obtained from national distribution of educational programs. Additional material is produced or purchased through consortium arrangements with regional associations.

Instructional Computing Materials

Computer materials (software) for K-12 classrooms are produced by numerous software publishing companies, computer hardware firms and even by some textbooks publishers.

4. How does the educational system relate to you?

The South Carolina Educational Television Network is a separate state agency from the South Carolina Department of Education. In a close collaborative arrangement, the two agencies combine to provide ITV programming and services for the states K-12 schools. S.C. ETV has the responsibility for program production, delivery, and network development.

5. Where is there any federal money now in the system in South Carolina? In the Nation?

There is no direct federal money for the production or acquisition of instructional television programs.

6. Where do satellites fit into today's system? Do you see that part growing?

The S. C. ETV Network delivers the national ITV schedule for the Public Broadcasting Service (PBS) (6 hours per day) by satellite. However, because of the costs it appears very unlikely that a given state on its own could afford to utilize satellite technology for distribution. Delivery may be affordable if states, by a consortium arrangement, could schedule program delivery by satellite. S. C. ETV utilizes an 8 channel (4 local, 4 statewide) ITFS (Instructional Television Fixed Service) system, 11 television broadcast stations, and 7 radio stations to deliver material to educational institutions in South Carolina.

7. Do we need a national center for this?

Yes. A strong national or regional center for program production would be a major asset. However, there is an existing regional structure for delivery in place.

There is a serious lack of new ITV programming being produced in this country. We have lost ITV producers due to lack of money for program development.

The life blood of our system is programming. We don't have a regular way of consistently developing and revising ITV programming. Each state is doing bits and pieces of this for their specific needs. We need a new way for cooperatively replenishing and creating the kinds of programs each agency needs to provide for its teachers.

8. What is the greatest need right now to help this along?

Make funding to support creation of new ITV programming available. Funds also need to be made available to support television production equipment and delivery systems.

SENATOR PELL

1. Do exemplary educational telecommunications programs currently exist, and if so how are they currently transmitted?

Yes, the programs produced by S. C. ETV in cooperation with the State Department of Education have a twenty-five year history of effectiveness in the schools in South Carolina. Currently 93% of the schools in our state use ITV. Transmission is by local, regional, and state networks over broadcast, Instructional Television Fixed Service, cable television and satellite distribution.

2. How much teacher training is required to use telecommunications effectively? Are teachers involved in the development of these training programs?

For both instructional television and computer instruction by telecommunications, a significant amount of teacher training is needed to make the most effective use of the resources. When courses are produced in South Carolina, teachers are involved in the development and evaluation process. There is a statewide system that includes program development committees and content specialists as well as local teachers.

The CHAIRMAN. We have got two panels left and I am going to ask if they would both come up and appear jointly. We have the teacher panel and the student panel. Represented on the student panel, Alda Monteiro, a Senior at East Providence Senior High School, East Providence, Rhode Island, and Benjamin Stavely, a Junior at Alvirne High School, in Hudson, New Hampshire; and then I would ask our teachers, Marilyn Gardner, who is the Director of Instructional Technology, Boston Public Schools, Chairman of the Technology Committee, and Robert Bennett, Advanced Placement Physics Teacher, Wakefield High School, Wakefield, Massachusetts.

We will start with our student panel. We welcome you here. We thank you for your willingness to give up some time. I don't know whether anyone is missing classes today or missing teaching, but we are delighted to have you here and we look forward to hearing from you.

STATEMENT OF ALDA MONTEIRO, SENIOR, EAST PROVIDENCE SENIOR HIGH SCHOOL; BENJAMIN STAVELY, JUNIOR, ALVIRNE HIGH SCHOOL; MARILYN GARDNER, DIRECTOR OF INSTRUCTIONAL TECHNOLOGY, BOSTON PUBLIC SCHOOLS; AND ROBERT BENNETT, ADVANCED PLACEMENT PHYSICS TEACHER, WAKEFIELD HIGH SCHOOL

Ms. MONTEIRO. Senator Kennedy, I am very glad to be here today. Thank you for inviting me here. I am Alda Monteiro, and I am a Senior at East Providence Senior High School.

I studied French for four years and I wanted to continue to study French in my senior year. However, due to the low enrollment in our school, only three students signed up for French V and the French V class was cancelled.

If the telecommunications system that you propose had existed then, I could have continued to study French in my senior year. Additionally, I am interested in sciences. I have exhausted all the science courses at my school. I have had two years of biology, one of physics and one of chemistry. I would have benefited by taking a second year in chemistry and a course in human genetics which my school cannot provide.

I must continue my education in these courses in college next fall. Yesterday, I talked with nine students interested in the sciences. All of them would have liked to take courses that our school does not have. For example, there is one girl who is a junior who is now taking calculus. Next year, she will have to find some other way to continue her education in mathematics.

Another student wants to study marine biology, something that our school cannot provide for him. It is something that he could have studied if our school had been connected with the University of Rhode Island which offers an excellent program in marine biology.

Other students would have taken an advanced course in calculus and a second year in physics, both of which our school again does not have. No school can offer every course but through telecommunications students with individual needs can be helped and they can continue their education.

I understand that some people are doubtful about our students and teachers communicating through television. I do not think that would be a problem. We have television monitors in every single classroom in the school and we have a control room and a studio from which we can produce and televise programs to every classroom in the school. We have already made use of the video equipment. Our teacher tapes debates in class to show us what we are doing wrong, and the students in our school are very enthusiastic about using the equipment and they are very interested in using the equipment. They have no fear about using it at all, because they have grown up surrounded by television and it is just a part of our American culture, and it is going to continue to grow and develop and we are just going to have to take advantage of it.

Thank you.

The CHAIRMAN. Very good, Alda.

I see Senator Pell here who, as you know, is the Chairman of the Education Subcommittee. He would be interested in all of the testimony and I know that he would probably like to say a word of welcome.

Senator PELL. I would like to very much indeed. I thank the Chairman for his graciousness in letting me jump in at this moment and say how nice it is to meet Ms. Monteiro from my own State.

Ms. MONTEIRO. I am glad to meet you, too. I am glad to have someone from Rhode Island here today.

Senator PELL. It is very good to see you. I want to commend the Chairman, too, on this hearing because since the time of Socrates and Aristotle, there has been really very little advance in how you transfer a body of knowledge from one man's mind to another man's mind. I think the ideas that we are exploring in this hearing are very positive and constructive ones and I congratulate the Chairman on moving in this direction. I would ask that my statement be inserted in the record as if read.

The CHAIRMAN. We thank you very much.

Senator PELL. I apologize, but I also have a meeting of the Foreign Relations Committee and——

The CHAIRMAN. We understand that Senator Pell is Chairman of the Foreign Relations Committee and has some very important matters down there. We are delighted to have him come by here, and I think the comments that Alda has made have been very supportive and very interesting and very compelling.

Senator PELL. I would like also, if I could, to leave a couple of questions for the record.

The CHAIRMAN. Fine. Thank you.

Okay. Benjamin?

Mr. STAVELY. Thank you, Mr. Kennedy.

First, I am Ben Stavely, from Alvirne High School, in Hudson, New Hampshire. I would like to thank you first for allowing me to be here today to speak about the possibility of getting a networking system as an educational tool at the high school level.

Students would benefit from this in three main ways: First, it would allow high schools to increase the number of classes which they can offer their students. This is very important because there

are many students who cannot take the classes they would like to take because they are not offered.

For example, I am a junior, I have a full year left in high school, but I have already exhausted all the math and science courses which my high school offers. If we had this system, I would be able to continue my studies in these areas.

Secondly, this will allow teachers to keep up with changing technology. This is especially important in the computer education department, which teachers oftentimes do not have the background they should have to teach these courses.

Thirdly and lastly, students should receive the applications of telecommunications. Telecommunications is a very important subject right now, and if they receive these applications they will be better prepared for the future.

Thank you.

The CHAIRMAN. Thank you, Benjamin.

Just before moving to our teacher panel, we heard similar testimony up in Massachusetts. We had a couple of students who wanted to take advanced courses. In one case the courses were given in the summer and the student could go to an educational setting. Actually it was an old alma mater, Milton, but the student had to work in order to prepare for continuing education and they were put in the dilemma of either taking additional courses or working.

You have the question of availability. We found schools in our State that would let some students out to take courses elsewhere, but often when they would let them out to go to where they would be able to get a course that interrupted both other educational pursuits and some other kinds of pursuits. I thought it was very interesting and valuable to hear the comments that you each made. They were similar to comments that we have heard from other students.

I know, Mr. Stavely, that Senator Humphrey would want me to extend a warm word of welcome. He is a member of this Committee and I know he would want me to extend a word of welcome to you.

Now we will go to the teacher panel and come back to you with some questions. We welcome the two citizens from our State and we look forward to hearing from you.

Dr. GARDNER. Good afternoon. I think my goal today is to beat the buzzer. You guys did a neat job and I am really going to try to finish up in the alloted time.

I want to thank you for inviting me here today and I guess I just want to start by saying that I think this proposal is a vision. It is a vision for educators and the author is visionary. It is not something that might happen, but something that needs to happen and will happen and I think we really have to seriously consider "Star Schools."

My concern is that what we are starting to do in education is implement bits and pieces of the "Star Schools" project. My job, as Director of Technology for Boston schools, entails everything from developing curriculum, to purchasing and installing the equipment, and professional development. What I find and my colleagues in other urban school districts throughout the country find ourselves

doing is spending a lot of time writing individual proposals, $10,000 here, $15,000 there, and trying to put the bits and pieces of what this visionary project is in our districts now.

At the rate I am going, it is going to take me and my staff of ten people five, ten, or maybe fifteen years to get to where we need to go with telecommunications in education. This is a real concern to me, considering the limited resources available. I do not anticipate that we will do a quality job in what needs to happen by doing the bits and pieces approach.

I think it is important to remember, and we keep forgetting, that teachers are isolated. They are in their classrooms, they are alone. We talk a lot about training. I have not heard anybody mention just the real fact of communication, communication with each other. Literally, a teacher, after graduating from college, can stay in their classroom and never talk to another teacher, never go to another training course (which are usually not required). We really have to think about how this isolation is affecting the education of our children that are in front of them every day.

I will give you a perfect example of one bit and piece approach that I am putting together right now in Boston. We are networking five elementary schools. You would think Prince Charles was coming with the excitement of networking these five elementary schools. We are giving the teachers the capability of telecommunicating with each other, five elementary teachers in five different schools. We are also putting telecommunications capabilities in the principal's office, in the district superintendent's office, and in the Director of Math's office. This is a math project called TeachNET.

None of these elementary school teachers have probably ever talked to a curriculum leader in Boston Public Schools or the Director of Math. None of the teachers have probably even talked to the curriculum leader in their district (the district superintendent), nor to the curriculum leader of the school (the principal) more than once a week.

With the TeachNET proposal, instead of playing telephone tag, educators have an opportunity to have access to other educators. These key educators are going to be able to interact with each other and talk about some major math issues. What is going on in the classroom, what is not, where can I get this resource, et cetera? This is just simple communication using technology that is going to improve the teaching of teachers and improve, of course, the education of our students.

Forget about just impacting teachers within a district. It is even more exciting to improve teacher communication among districts. We have another project that we did last year called Solutions Unlimited. It was a math project where our math teachers had a chance through telecommunications to interact with school districts in other parts of Massachusetts over particular pieces of math software that they were using. I could give other examples but I think I made my point that besides re-training the communication exchange among teachers is key.

The issue of retraining is also critical and one which the "Star Schools" legislation could play a key role.

No one likes to think that what they have been doing for ten, fifteen, twenty years is wrong. I will give you a perfect example.

We put 24 word-processing labs in our 24 middle schools. If I had put out an advertisement that we were going to retrain teachers in the writing process, I would probably have had five English teachers show up for the training.

We instead said we were going to teach through a new technology of which they were not familiar, word processing. I have to tell you of the 15-hour course, maybe four or five hours was on the mechanics of using word processing. The teachers did not realize that the other 10 hours was actually retraining on the writing process.

The point I am trying to make—and we have done this in other curriculum areas—is that technology gives us an opportunity to retrain teachers and not have them feel threatened that what they have been doing in the classroom for the last ten years is wrong. Technology gives us a second chance, another opportunity and another vehicle for retraining.

There have been numerous school department and union surveys which indicate teachers are interested in receiving training. However, how does a school district like Boston, with 8,000 employees, begin to handle the whole retraining issue. Sure, it is possible to ask teachers to come before school, after school, and travel to different locations to attend particular training workshops. Training has to happen during the day and has to happen at the school site to save valuable teacher time and energy. Star schools offer us this opportunity.

I think "Star Schools" medium is definitely appropriate. Telecommunications is a valuable tool and I believe it can do two things. It can increase student achievement and it can improve teaching methods. I have seen it work in Boston schools on a limited basis, and I know it is working in other urban school districts in this country and having a major effect on the two aforementioned goals that we are seeking to achieve.

I have to say that what we have now in education is not working. I have been with Boston schools for seventeen years. I have been involved in every aspect of education, professional development, curriculum development, et cetera. What we have is not working. I think the star schools project is part of the answer. There is nothing before us in education right now that is the answer to our problems. I do believe this is a piece of the answer.

We can either wait and do it piecemeal or we can accept the leadership being offered by the "star schools project." I think what you are offering us nationally with the "star schools project," is leadership. We cannot do it alone. The school districts will not do it alone and cannot do it alone. We need a national effort that is going to make a difference, or what star schools is offering will be done piecemeal by the districts and look like a patch quilt when it's done. What is going to happen—and we can already see bits and pieces going on in the school districts—is that everybody will have different bulletin boards and different communications systems. We will also have once again the "haves and the have-nots," like so many other programs in this country. I think it is critical that we seriously take a look at the "star schools" proposal and move forward to where we need to go.

Thank you.

The CHAIRMAN. Very, very good. We will come back with some questions.

Robert Bennett?

Mr. BENNETT. My name is Dr. Robert Bennett. I am a physics teacher at Wakefield High School, Wakefield, Massachusetts. I have been teaching physics for twenty-five years.

May I first thank you for the opportunity to be here. Never in my life did I ever expect to be in Washington, D.C., giving testimony to a Senate committee, just being a teacher. I appreciate it very much.

When I was doing my doctoral dissertation at B.U., I became severely aware of the shortage of engineers in this country and the pending problem. Science Magazine and Scientific American has warned about this for the last ten to twelve years, if you did some research on that matter.

I teach a course called advanced placement physics, C level. C level indicates that calculus is the base of the instruction, the student must be concurrently taking calculus.

The problems we are facing right now are two-fold, declining enrollments and budgetary constraints. My present situation at Wakefield High School is that I may not be teaching AP physics next year. We only have three students enrolled at this time and we require six to conduct the course. We have the resources at Wakefield High School, but we do not have the enrollments. We cannot fiscally justify my teaching two periods a day of advanced placement physics to three students. It will be a tragedy when it becomes a reality.

But we should not be in the business of telling bright and capable students "you cannot do it." If I can give you a couple examples of former students: James and John Guilford, identical twins. When they finished their junior year, they had each four 800s and a pair of perfect 5s in AP calculus and AP physics. I can only wonder what they could have achieved if we had access to input from a telecommunications network from various institutions.

John today is a design engineer with Hewlett-Packard, and James is performing bubble research at IBM. Coincidentally, we have formed a network between the communities of Wakefield, Reading, North Reading, and Lynnfield. The first link was achieved yesterday at 12:30. We successfully had a two-way audio-video interaction transmission, with clear audio and clear video between Reading High School and Wakefield High School. This network is intended to tie into the University at Lowell, which will give us direct access to resources that are just not available today in a public school setting.

We at Wakefield, Reading, North Reading, and Lynnfield are committed to the design, construction and educational implementation of a two-way interactive system that will be linked to the University at Lowell. We have to move forward. We cannot idly sit back and rest on our successes. There are John and James Guilfords in every community in this country. They are being denied an educational opportunity that could be provided by this technology access.

Thank you, Senator.

The CHAIRMAN. Thank you very much. This point that you raise about the change and the shifting of courses and curriculum availability that you mentioned here is replicated all over our Commonwealth, and, I am sure, all over the country from the stories that you are telling.

At a time when there is a national need in terms of these kinds of skills, we are finding an increasing number of districts dropping these courses as we get into these budgetary crunches. So you find the kind of situation that Benjamin and Alda talked about in terms of the gifted students, where there is a shortage of programs. You are finding out how many students would like to take courses, yet a number of school districts have had to drop those programs. As Ms. Gardner pointed out, we are just not going to be able to expect the various school districts to be able to patch these matters together.

Again, I would like to ask both of you about the reaction generally of teachers to this concept. There have been many instances where politicians are reluctant to see many alterations or changes in terms of politics, and the question is whether teachers are going to be reluctant to see changes in terms of this kind of a device. I do not know what you will be able to tell us.

Ms. GARDNER. I would say absolutely not. It is my experience that just the concept of technology interests them and when they see what can happen in the sharing of ideas and materials, et cetera, and the communication resources back and forth, has been overwhelming, their interest in becoming involved.

Mr. BENNETT. I have gone through several conferences with various associations with teachers represented and they are concerned: Is this technology going to be used to replace their positions? What we are going to do is we are going to deal with the programs that we are going to lose, we are trying to save the programs, not replace teachers. When it is properly addressed, the fear is not there.

Ms. MONTEIRO. I would like to comment on that, Mr. Kennedy.

The CHAIRMAN. Yes.

Ms. MONTEIRO. In our school, one of our teachers has started a television production class to teach students how to use the equipment. I am in that class and other teachers are starting to use the equipment as part of the teaching tools to teach their students what they are doing wrong in class by videotaping them and showing it back later, so our teachers are not afraid to use the equipment and they see it as a helpful tool for them.

Thank you.

The CHAIRMAN. Very good.

We have Senator Humphrey here. We have a constituent of yours, Senator Humphrey, Benjamin Stavely, who gave us a good comment about what he sees as the useful advantages of this proposal and he made, I think, a very helpful comment.

We have had a good session here this afternoon. We have heard what is happening in different States, some of the important success stories, some of the challenges that exist for many of our youngest and most talented students, because of the reductions in availability of curriculum in many different school districts. We heard how students see this as a concept that might offer them better opportunities for other classes and about the readiness of

teachers to use these kinds of technologies. We heard about the results in one State, South Carolina, where the academic achievement in terms of the various tests have held in the use of this kind of technology. There has been a lot of very, very helpful comments on this subject matter and I think we have made a good record here.

I do not know whether there is anything you would like to add or comment on.

Senator HUMPHREY. Thank you. I want to welcome my constituent, naturally. I am sure he did as well as you said. I would just observe that we could use a little of the advance in telecommunications around this place. The reason I am so very late today for this hearing is that there are four hearings going on right now in which I am supposed to be participating simultaneously, and if we had a little bank of TV monitors here we might be able to do all the things that we are supposed to do, just with the flick of a switch.

In all sincerity, in seriousness, this revolution in telecommunications I think is one of the most exciting advents of our age, and it is certainly going to work to the benefit of our society and for the entire world, for that matter, more than we dream.

Thank you.

The CHAIRMAN. Well, we want to thank you very much. Again, you were very good to make the trip down here and we would like to also think we might ask you, as we move through the consideration of this in committee, if we have additional problems or further questions, that we will be able to get back in touch with you as well.

I want to thank you all very much.

Mr. BENNETT. If you would like a demonstration some day, just come to Wakefield High School and we will demonstrate this thing to you.

The CHAIRMAN. I might very well take you up on it. Thank you very much.

The committee stands in recess.

[Whereupon, at 4:40 p.m., the committee recessed, subject to the call of the Chair.]

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